

RADIO-AUTOMOBILES-NEW INVENTIONS

Popular Science

MONTHLY

FOUNDED 1872



Jack Binns' Ten Commandments for Success with Your Radio Set (^{Page}
₄₂)

How to "Tune Up" Your Car and Double Your Mileage

NOVEMBER

Over 70 Useful Things to Make with Tools

25 CENTS

VACUUM TUBES

CUNNINGHAM

*Built
To Give Maximum
Efficiency*

VACUUM tubes are used for two distinct individual purposes in a receiving set—as DETECTORS and as AMPLIFIERS. The qualifications of a tube for these two uses are so different that for maximum efficiency tubes of entirely different design must be used.

This point was one of the chief considerations of the research engineers who designed Cunningham tubes in the great laboratories of the General Electric Company. After years of research and experimental work, the Cunningham C-300, a SUPER-SENSITIVE DETECTOR, and the Cunningham C-301, a DISTORTIONLESS AMPLIFIER, were developed. These two tubes, now nationally recognized as standards for all types of receiving sets, are responsible for the highly perfected results obtainable in radio phone reception.

Amplifies As It Detects

TYPE C-300
GAS CONTENT
DETECTOR
\$5.00

TYPE C-301
HIGH VACUUM
AMPLIFIER
\$6.50

PATENT NOTICE

Cunningham tubes are covered by patents dated 11-7-05,
1-13-06, 2-18-06 and others issued and pending. Licensed
only for amateur or experimental uses in radio com-
munication. Any other use will be an
infringement.



The trade mark GE
is the guarantee of
these quality tubes.
Each tube is built to
most rigid specifications.



CUNNINGHAM
TYPE C-300
PATENTED

E.J. Cunningham

Trading at

AUDIOTRON MFG. COMPANY

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San Francisco, Calif.

334 West Lake Street
Chicago, Illinois



An Amazingly Easy Way to Earn \$10,000 a Year

Let Me Show You How Free

To the average man the \$10,000 a year job is only a dream. Yet today there are a surprising number of men earning five figure salaries who were merely dreaming of them a short while ago. The secret of their success should prove a startling revelation to every ambitious man who has ever aspired to get into the \$10,000 a year class.

There is nothing fundamentally "different" about the man whose salary runs into five figures. He is made of the same stuff as you and I. It is not necessary that he must enjoy the privilege of some influential connection or "pull." For example take J. P. Overstreet, of Delano, Texas. A few short years ago he was a police officer earning less than \$1,000 a year. To-day his earnings are in excess of \$1,000 a month—more than \$12,000 a year. C. W. Campbell, Greensburg, Pa., was formerly a railroad employee on a small salary—last month his earnings were \$1,562.

Why Salesmen Earn Such Big Pay

Just stop a moment and think over the successful men of your acquaintance. How many of them are connected with some form of selling? If you will study any business organization you will see that the big jobs go to the men who sell, for upon their efforts depend the profits a company makes. Without trained men to place a product on the market, the finest goods are worth no more than so much clay. Salesmen are the very nerve centers of a business. Is it any wonder that they earn big pay?

The man who starts working as a bookkeeper or clerk for \$25.00 a week, never increases his value to the firm. Any advance in pay is merely a reward for length of service. At the end of ten years he is no more essential to the life of the organization than he was at the end of ten weeks. He is only a necessary liability—drawing his pay because somebody must be hired to work at the unimportant, routine jobs. Once established in the rut, he becomes a cog in the machine—when he is worn out, he can be easily and cheaply replaced.

Why Don't You Get Into the Selling Field?

Mr. Overstreet, Mr. Campbell and the others whose letters you see on this page are all successful salesmen. They realized their ambitions by landing \$10,000 jobs in an amazingly simple way, with the help and guidance of the National Salesmen's Training Association. Sometime—somewhere back in the past, each one of them read of this remarkable course of Salesmanship training and Employment Service just as you are reading of it to-day. Each one of them was disillusioned with his earning capacity—as perhaps you are—and each one cast his lot with the N. S. T. A. To-day they are important factors in the business world—enjoying all the comforts and luxuries money can buy. And yet they are not ex-

ceptions, for there are thousands of N. S. T. A. trained salesmen who are making big money, as we will be only too glad to show you if you will mail the coupon.

We Train You and Help You Land a Job

The National Salesmen's Training Association is an organization of top-notch salesmen and sales managers formed for the express purpose of training men in the science of successful selling. You do not need to know the first thing about selling—for the N. S. T. A. trains you from the ground up—gives you a complete insight into selling methods—in your spare time without making it necessary to give up

your present position until you are ready to begin actual selling.

In addition to this remarkably efficient course of training, the N. S. T. A. maintains a Free Employment Service to help its Members to jobs in the lines for which they are best suited. This in itself is of incalculable value for it allows the prospective salesman to make a complete survey of the selling field and to select the work which most appeals to him.

Salesmen Are Needed—Now!

Get out of that rut! Work for yourself! Salesmanship is the biggest paid of all professions. Just because you have never sold anything is no sign that you can't. We have made Star Salesmen of men from all walks of life, with no previous selling experience. These men have jumped from small pay jobs to big selling positions and handsome incomes. The same training on which they founded their success is open to you. You can follow in their footsteps. Why don't you get in a class with men who make real money? Never before have the opportunities been greater. At least you cannot afford not to investigate the great field of selling and see what it offers you. It will only cost you a 2 cent stamp and the facts and proof you will receive will surprise you.

Free Book on Salesmanship

Just mail the coupon or write for our free illustrated Book, "Modern Salesmanship," which we will be glad to send without any obligation on your part. Let us prove to you that regardless of what you are doing now, you can quickly become a Star Salesman. Let us show you how you too can step into the ranks of these big money makers of business. See how easily you can learn this fascinating, big pay profession at home in your spare time. Learn what we have done for others and what we stand ready to do for you. Don't put it off until to-morrow—write us to-day. Every hour lost keeps you that much further from success. Mail the coupon at once.

National Salesmen's Training Association
Dept. 15-S, Chicago, Ill., U. S. A.

National Salesmen's Training Association
Dept. 15-S, Chicago, Ill., U. S. A.

Please send me, without any obligation on my part, your free book, "Modern Salesmanship," and full information about the N. S. T. A. system of Salesmanship training and Employment Service. Also a list showing lines of business with openings for salesmen.

Name _____

Street _____

City _____

Age _____ Occupation _____

Read These Amazing Stories of Quick Success

Earned \$524 in Two Weeks

I have never earned more than \$60 a month. Last week I cleared \$208 and this week \$218. You have done wonders for me.—Geo. W. Kearns, Oklahoma City, Okla.

I Now Earn as High as \$100 a Day

I took your course two years ago. Was earning \$16 a week cleaning. Am now selling many of the largest firms in the U. S. I have earned more than \$100 in a day. You helped me get the position.—One Sales Manager is a graduate of yours.—J. L. Bellows, Chicago, Ill.

Earns \$1,562 in Thirty Days

My earnings for the past thirty days are \$1,562, and I was forced home to March although I only worked two weeks during that month.—C. W. Campbell, Greensburg, Pa.

Earned \$1,500 in Six Weeks

As soon as I received a letter from you and your literature, I knew that I was on the right track and very soon after I applied for a position as a Salesman to one of the firms whom you informed me were in need of a Salesman and in whom you had recommended me. As soon as they received my application, which was by mail, they wired me to come for an appointment which I did, with the result being that I sold my services to them in about thirty minutes, took a territory in Illinois and Wisconsin and made a success of it from the very first week.

From that time on I have been what might be termed as a "high pressure" Salesman selling lines where nine out of ten Order Takers would fail. I have sold goods in a highly successful manner in nine or ten States, both North and South. My earnings for March were over \$1,000 and over \$1,500 for the last six weeks, while last week my earnings were \$1,562. I travel eleven months out of the year, working five days each week.

The N. S. T. A. dug me out of a rut where I was earning less than \$1,000 a year and showed me how to make a success.—J. P. Overstreet, Delano, Texas.

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25 cents a Copy; \$2.50 a Year



Published in New York City at
225 West Thirty-ninth Street

Our National Crime against Good Health—the Way We Heat Our Homes!

THE fact that the air in your home during the winter is more arid than the atmosphere of any desert in the world may astonish you. But do you realize, also, that it involves an actual and grave menace to your health?

Read what noted experts have to say. You will learn that leading specialists consider the overheated dryness of the American home to be one of the chief causes of bad colds, sore throats, and serious winter infections of all kinds. Minor annoyances such as chapped hands are caused primarily by the dry heat indoors.

For Your Health's Sake

DO YOU know that soon after steam heat is turned on in apartments and offices, statistics show that illness takes a sudden jump?

There is probably no single convenience of modern homes that is so outright a menace to general health as the much-vaunted central heating system which Europe envies America!

AMAZING facts about heating arrangements, humidity, and health discovered by engineers and physicians, but ignored by the general public, are revealed in an eye-opening article in the next issue of POPULAR SCIENCE MONTHLY. This article is of vital importance to all your family's welfare.

A Whole Year for \$2.50

MAKE sure of having POPULAR SCIENCE MONTHLY come to you regularly for the next year. You want to keep up with the marvelous new discoveries of science. Every issue will contain practical suggestions worth more than the subscription price. Send \$2.50 for one year's subscription.

Uncle Sam Says Your Car Is Wasting 30% in Gas— Learn How to Save It!

GOVERNMENT engineers declare the average motorist wastes from 20 to 30 per cent of gasoline, just through faulty carburetor adjustment.

In the next issue of POPULAR SCIENCE MONTHLY are described the extraordinary results of recent experiments by the United States Bureau of Mines, which show that for lack of a simple device to switch the average carburetor instantly into various adjustments for hill climbing, starting, straight running, weather changes, etc., about one third of the 650 gallons of gasoline annually used by most motorists is practically thrown away.

WOULDNT you like to increase your mileage 25 per cent? That is what those government engineers did in the case of one popular-priced car, by simply adjusting the carburetor scientifically. And they have had similar success with many other makes.

You can do likewise. Harold F. Blanchard, POPULAR SCIENCE MONTHLY's automobile expert, tells in the next issue how to make these simple attachments.

Your Radio Problems

DON'T miss Jack Binns' "Ten Commandments for the Users of Vacuum Tube Sets." It gives expert advice and information to every man interested in radio.

"Standard Radio Guide"

THIS is the ideal book for the radio amateur. It tells simply and clearly all you want to know. It was written by the Radio Editor of POPULAR SCIENCE MONTHLY and answers all the questions our readers have asked about radio.

Price 50 cents postpaid.

And 116 Important News Articles

THE HOME WORKSHOP

Sixty New Ideas for Tool
Users, pages 77-125

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POPULAR SCIENCE MONTHLY

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O. R. Capen, Secretary and Treasurer

POPULAR SCIENCE MONTHLY,
225 W. 39th St.,
New York, N. Y.

Send me, postpaid, your
handbook, "The Standard
Radio Guide." I inclose
Fifty Cents (cash, check, or
money order).

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New York, N. Y.

Please enter my subscrip-
tion for one year for \$2.50.

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The Only Sure Way to Avoid Embarrassment



Do you know the correct thing to say in this embarrassing situation?



Do you know the correct thing to wear in every social occasion?



Do you know how to avoid embarrassment, especially after?



Do you know how to create conversation when left alone with a weird person?



Do you know what to say when you arrive late at an entertainment?

WE have all had our embarrassing moments. We all suffered moments of keen humiliation, when we wished that we had not done or said a certain thing. We have all longed, at some time or other, to know just what the right thing was to do, or say, or write.

Every day, in our business and social life, puzzling little questions of good conduct arise. We know that people judge us by our actions, and we want to do and say only what is absolutely in good form. But, oh, the embarrassing blunders that are made every day by people who do not know!

The Only Way

There is only one sure way to be calm and well-poised at all times—to be respected, honored and admired wherever you happen to be. And that is by knowing definitely, positively, the correct thing to do on all occasions. Whether you are dining in the most exclusive restaurant or at the most humble home, whether you are at the most elaborate ball or the most simple barn-dance, whether you are in the company of brilliant celebrities or ordinary people, you will be immune to all embarrassment, you will be safe from all blundering mistakes—if you know the simple rules of etiquette.

What Is Etiquette?

Etiquette is not a fad. It is not a principle or theory or belief. It is meant not merely for the very wealthy or for the extremely well-educated. It is meant for all people, who, in the course of their everyday life, find it necessary to keep themselves well in hand; to impress by their culture, their dignity; to know how to be trusted and respected in business and admitted in the social world; and for women who wish to be considered at all times cultured and charming.

It is embarrassing to overturn a cup of coffee and not know just what to say to the hostess. It is embarrassing to arrive late to an entertainment, and not know the correct way to excuse yourself. It is embarrassing to be introduced to some brilliant celebrity, and not know how to acknowledge the introduction and lead subtly to channels of interesting conversation.

The man who is polished, impressive, and the woman who is cultured, will find the doors of the most exclusive society opened to admit them. But the world is a harsh judge—and he who does not know what to do and say and wear on all occasions will find himself barred, ignored.

You have often wondered how to word invitations, how to acknowledge introductions, how to ask a lady to dance, how to act at the wedding, the funeral, the theatre, the opera. Here is your opportunity to find out the absolutely correct thing to do,

say, write and wear on all occasions.

The Book of Etiquette, in two large volumes, covers every detail of every-day etiquette. It tells you how to act at the dinner table, how to excuse yourself if you drop a fork, how to write and answer invitations, how to make and acknowledge introductions. It tells you what to wear to the dinner, the dance, the party, what to take on a trip to the South,

You cannot do without the Book of Etiquette. You need it to refer to whenever some important event is pending. You need it to refer to whenever you are in doubt, whenever you are puzzled, anxious. It corrects the blunders you have perhaps unknowingly been making; helps you to avoid all embarrassment; shows you the way to be always, at all times, cultured, impressive and charming.

Send No Money Five-Day FREE Examination

The complete two-volume set of the Book of Etiquette will be sent to you FREE for 5 days. Glance through the books. Read a page here and there. See for yourself some of the blunders you have been making. You will immediately realize that the Book of Etiquette is a wonderful help to you.

Just mail the coupon below, filled in with your name and address. Don't send any money—just the coupon. The two-volume Book of Etiquette will be sent to you at once—FREE to read, examine and study. After 5 days you have the privilege of returning the books without obligation, or keeping them and sending \$3.50 in full payment.

Do It NOW!

Send off the coupon today—now—before you forget. You've often wondered what you would do or say in a certain embarrassing situation. You've often wished you had some authoritative information regarding right conduct.

Don't overlook this opportunity to examine for yourself the famous Book of Etiquette. Don't wait until some very embarrassing incident makes you regret that you never knew the right thing to do or say. Here's your opportunity to examine the Book of Etiquette in your own home without cost. You cannot afford to miss this opportunity. Mail the coupon NOW. Nelson Doubleday, Inc., Dept. 2511, Garden City, N. Y.

**NELSON DOUBLEDAY, INC.
Dept. 2511, Garden City, N. Y.**

Without obligation on my part, and without any money in advance you may send me the complete two-volume set of the Book of Etiquette for free examination. Within 5 days after receipt I will either return the books or keep them and send you only \$3.50 in full payment.

Name _____

Please print name and address

Address _____

Check this square if you want these books with the beautiful full-leather binding at five dollars with 5 days' examination privilege.



Do you know the embarrassing blunders to be avoided at the wedding?



Do you know the correct way to introduce friends?



Do you know how to avoid embarrassment at exclusive restaurants?



Do you know the correct etiquette at the theatre and opera?



Specifications Sweeney Radio-Phone

Cabinet: Genuine solid walnut, hand rubbed.

Circuit: Tuning circuit consists of an antenna inductance with four taps and a series variable condenser wave lengths from 175 to 330 meters. Two radio frequency, detector, and two audio frequency amplifying tubes.

Panel: Bakelite 7x9½, 3/16 inch thick Control Knobs. Smooth running and easily adjusted. Only two adjustments required in tuning.

Terminals: are in rear of the cabinet to which the aerial ground, A battery and B battery are connected. Wiring and connections substantially made with 1/16 inch brass rod with cambric tube sleeves.

The New Sweeney Radio-Phone

Recognizing the demand for a set to receive the radiophone broadcasting of entertainment features as well as market reports and government information, our engineers have developed this receiver which incorporates simplicity of operation with its ability to receive long distance stations with clearness and sufficient volume to operate a loud speaking horn. The wave length range will cover those being used for the broadcasting of musical programs as well as the government live stock markets, grain quotations and weather forecasts. All sets are carefully constructed with the best quality of material and most careful workmanship. Each set is rigidly examined and tested before it is released. Radio frequency amplification, one of the newest developments in radio reception, is used, which accounts for the extreme sensitivity of the instrument and enables the operator to pick up long distance stations. The audio frequency amplification increases the signal strength to such a volume that any type of loud speaking horn at present on the market may be operated. Write for special low introductory price.

SWEENEY BROADCASTING W. H. B.

This Is One of the Largest Inland Stations in the Country

and sends out official Government market and weather reports every day, besides giving musical, educational and religious programs on Sundays, Tuesdays and Thursdays. Through the courtesy of C. G. Conn & Co., Elkhart, Ind., Makers of Musical Instruments, we are broadcasting some of their concerts.

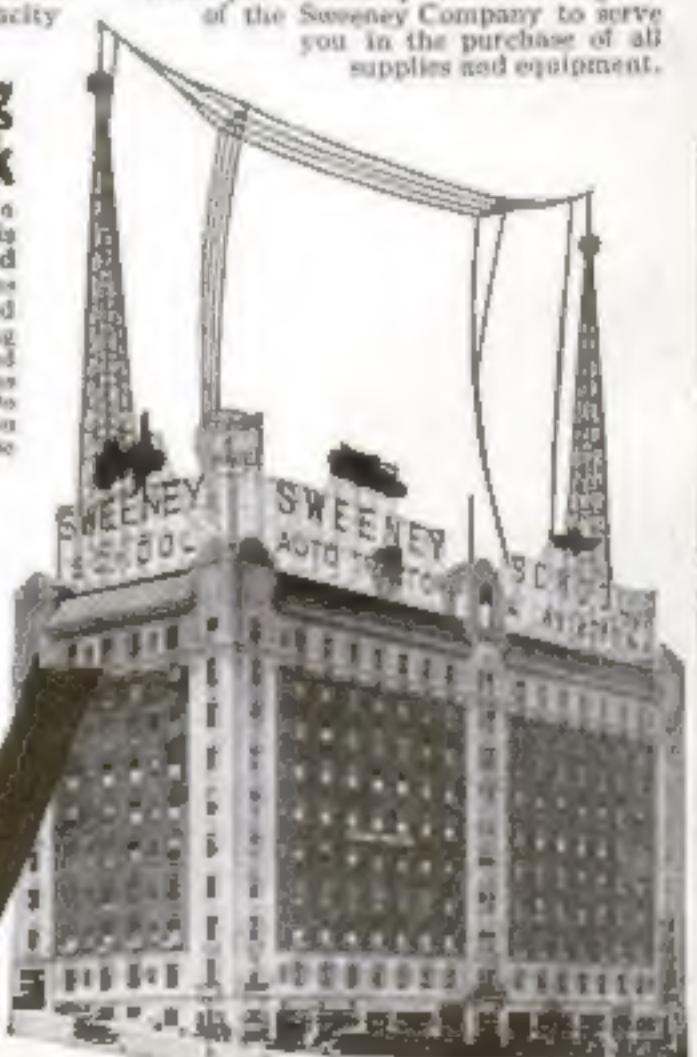
This station cost \$50,000 to erect. CALL IS-WHB—360 meters for concerts and 485 for Government reports. 500 watts W. E. set provides its power. This great station is evidence of the capacity of the Sweeney Company to serve you in the purchase of all supplies and equipment.

Get This Radio Catalog and Instruction Book

Every radio enthusiast should have a copy of this valuable book which is just off the press. Contains new and interesting matter and descriptions and hints that will save you time and money, including hookups showing connections of crystal, regenerative, and high frequency amplification apparatus and give you much better results. Do not buy any radio supplies until you have seen this book as we have gone into this business on a great scale and are prepared to supply you with the best and most efficient new material at lowest prices. This book has been prepared by some of the best known electrical and radio engineers and practical instructors. Sent on receipt of Twenty-Five cents in stamps. Get your copy today.



Sweeney
RADIO & ELECTRICAL CO
1113 UNION STATION PLAZA, KANSAS CITY, MO



1	2	3	4	5	6	7
bright	white	attractive	active	good	real	strong
radiant	snowy	pleasing	busy	fine	true	potent
vivid	chalky	charming	alert	splendid	genuine	powerful
brilliant	milky	magnetic	brisk	excellent	sterling	keen
glowing	hoary	enticing	lively	prime	sincere	intense

Pick Out the 7 Best Words

Can you tell which is the most convincing word in each list? Try it. Learn to use words that win.

STUDY the words at the top of this page. See if you can select the most effective word in each list.

It's a mighty important thing to do. For the ability to use the right words in the right way, is one of the biggest, money-making powers you can possess.

No matter who you are—where you are—or what your daily task—words are the tools with which you work.

The only way you accomplish anything is through the use of words.

It makes no difference whether you are selling goods, buying goods, applying for a position or asking for an increase in salary, you must do it with words.

Therefore, the knowledge of how to use powerful, constructive, convincing words instead of weak, negative, ineffective words is of the utmost importance to you every waking minute of the day.

One reason why so many people are less than fifty per cent. efficient in speaking or writing, is because they use old, overworked, played-out, unconvincing words and phrases that have lost their power to interest and convince—words that no longer possess any real, forceful meaning.

To learn to use right words instead of wrong words, get and read our new, free book, *The Secret of Making People Say "Yes."*

Wrong Words Are Costly

The mistakes you make in the use of words cost money.

You gain or lose your friends—your position—your customers—your practice—your trade—by what you say and what you write.

Knowing how to express yourself in words that attract, interest and convince, often means the difference between humiliating failure and triumphant success.

Why is it that some salesmen earn \$10,000 a year, while others, in the same line of work and with the same opportunities make only \$3,000?

Why is it that one public speaker causes his audience to cheer with approval, and another speaker leaves them cold and unresponsive?

Why is it that one letter lands a good position while others only land in the waste-basket?

Why is it some people are popular in society and make hosts of friends, while others, equally deserving, make no social headway whatever?

The answer is simple. It is because some people know what to say and how to say it. Others do not.

The subtle knack of expressing ourselves in a way that immediately secures the attention of others—the power to use interesting, forceful language—language that convinces—is the secret of success in almost every walk of life.

How to attain this knack is clearly set forth in our free booklet.

\$10,000 a Year to Write Letters

Not long ago a business house advertised for a man to write their sales letters. The position paid a salary of \$10,000 a year. The

man who got the job and earns that handsome salary, does so simply because he knows how to use persuasive, compelling words instead of ordinary, unconvincing words.

There is an expert letter writer in New York City who prepares sales letters for some of the biggest business houses. It is said that he receives as high as \$500 for a single letter. This seems a big price. But when you know that one of his letters sent to a big list of names, brought in more than \$110,000 in orders, you can easily see that such a business-bringing letter is cheap at two or three times \$500.

Any man who can put words on paper—in letters, circulars, catalogs, etc.—in a way that attracts, interests and convinces his readers can charge a great big price for his services.

And remember this: the only difference between the successful letters, circulars, or catalogs, and the unsuccessful ones—the kind that fill waste-baskets—is the difference in the words they contain—the

FREE!

Mail coupon at once for a free copy of our new booklet which gives *The Secret of Making People Say "Yes."* You will find it amazingly interesting. Only 10,000 copies are now being distributed. They won't last long. So, get yours today!

difference between clear, positive, convincing language and hazy, negative, unconvincing language. You will be impressed in this important point as set forth in our free booklet.

Overcome Timidity and Fear

One of the important things that a knowledge of words—a mastery of speech—brings to you, is a total freedom from humiliating embarrassment and self-consciousness.

Men and women who are able to express themselves freely and fluently—who know what to say and how to say it—under all circumstances—never fall victims to the distressing influences of timidity and fear.

The ability to talk or write clearly, readily and easily at all times and under all conditions, produces a poise and power that can be obtained in no other way.

That quaking nervousness—that chilling fear—that overcomes most people when meeting strangers, when called upon to make a speech, or when they find themselves in any unusual position, is due almost entirely to the fact that they lack the power of self-expression. They do not know what to say or how to say it.

Why suffer in this way? Get our free book and learn how to get rid of this embarrassing difficulty.

Success Depends on Words

We are all salesmen—every mother's son of us. Some of us are selling merchandise. Some are selling services. Some are selling only themselves.

But every one of us is trying to sell something to somebody. In other words, we are trying to convince somebody of something. We are trying to get others to do what we want them to do. We are trying to get them to say "Yes" instead of "No." And we must do it with words.

So, you see, we all need a knowledge of the right use of words, because we all want to become better salesmen, no matter what we are selling.

The only way we can sell is by talking or writing. Therefore, our success depends upon our knowledge of what words to use and how to use them.

Get this important knowledge and get it now.

What Right Words Will Do For You

Our free booklet—*The Secret of Making People Say "Yes"*—points out the quickest and easiest way for you to learn to express yourself with the forceful effectiveness that persuades people to do what you want them to do.

It shows you how to gain a command of powerful English that enables you to get a good—or a better—position.

- secure an increase in salary
- successfully handle important business deals
- make bigger sales and more of them
- expel embarrassing mistakes
- collect money
- write letters that win
- secure financial, and other accommodations
- attract worth-while friends
- win the admiration of those you care for.

A knowledge of the skillful use of words doubles your powers of accomplishment, by doubling your ability to influence others. It gives you the power to persuade, which is the real secret of success.

Get this free book at once. It is the key to effective speech.

Do Not Delay

Send for this free book now. Do not put it off. Only 10,000 copies are now being distributed. They are sent to any one who asks for them—without cost or obligation of any kind. They will not last long. So, if you want one, be prompt.

You cannot possibly judge in advance of seeing it, what this little book can do for you, but

- by showing you how to get the maximum results from the right use of words;
- by showing you how you can easily acquire the word power to attract, interest and convince others;

- by showing you just how to please people and persuade them to say "Yes" instead of "No," it will convince you, beyond a shadow of doubt, that you took a wise step in sending for it, and that it is the most fascinating and valuable little book of information you ever got for the asking.

Send the coupon today—before the present edition is all distributed. Independent Corporation, Dept. B E-7711, 15 West 37th Street, New York.

Use This Coupon

INDEPENDENT CORPORATION

Dept. B E-7711, 15 West 37th Street, New York

Gentlemen: I accept your offer of a free copy of *The Secret of Making People Say "Yes."* Mail it at once to

Name.....

Address.....

Pop. No. 11-22

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AUTOMOBILE Mechanics, Owners, Garagemen, Repairmen, send for free copy America's Popular Motor Magazine. Contains helpful descriptive information on overhauling, ignition wiring, carburetors, batteries, etc. Automobile Digest, 511 Butler Building, Cincinnati, Ohio.

\$100.00 weekly manufacturing automobile specialist. Repairing, reconditioning, automobiles, easily learnt at home. Indispensable to all automobile trade people. Manufactured, etc. Frederick L. Wilder, Menominee, Wisconsin.

25 MILLION car drivers of us. Send ten cents, well addressed stamped envelope, address of two friends and receive complete instructions for obtaining this service on Ford, other automobiles in proportion. John Smith, Fourteenth Nineteenth W. Muskeetanna Avenue, Philadelphia.

SAVE your broken battery jars, quickly repaired, also magnetic collector rings, starters, curves and all radio and rubber parts. By order H. R. Cooper. Mailed day parts per bottle. Duluth Automobile Mfg. Co., Duluth, Minn.

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FORD ACCESSORIES

SPEEDSTER fans—see "Ited-i-Kut" ad page 101.

CYCLO "Dynamic" provides remarkable solution of hot-spot problem. Cyclo Manufacturing Co., Chestnut St., Akron, Ohio.

FORD OWNERS—Keep your car looking neat and trim. Huron's Flexible Fender Brake holds fenders in correct position, keeps them from sagging, lessens tire wear. This money for agents. Send one dollar for sample and particulars. Huron's Shop, Huntsville, Alabama.

WANTED

DETECTIVES—Excellent opportunity. Fascinating work, requiring unremitting, Partnership free. Wells American Detective System, 1144 Broadway, New York.

COINS for old gold, platinum, silver, diamonds, Liberty Bonds, war, coins, unused postage stamps, false teeth, Magneto, Potato, fish, any valuables. Mail in today. Cash sent, return mail. Goods returned in ten days if you're not satisfied. Ohio Remodeling Co., 300 Hippodrome Bldg., Cleveland, Ohio.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

DUPLICATING SERVICES

"MODERN" Duplicators save Time, Labor and Money. One thousand reproductions Typewritten or Printed Letters, Drawings, Logos, Signs, Menus, Bills, Notices, Specifications. Maps or anything in one or more colors. Prints TWO per minute. Special Sale On. 30 Days Free Trial. \$2.50 up. Booklet free. J. V. Durkin-Krebs Co., Pittsburgh, Pennsylvania.

TRADE SCHOOLS

DENTAL laboratory work quickly taught through individual instruction. Our graduation is great demand, earn \$100 to \$600 yearly. Earn while you learn. Send for Bulletin 4 McCarr School of Mechanical Dentistry, 34 West Lake Street, Chicago.

EARN more money—Learn sign painting, scenic painting, showcard writing, auto painting, paper hanging, decorating, drapery, marbling, at Chelco or at your home. Chicago Painting School, 157 West Austin Avenue, Chicago.

LABORATORY AND CHEMICAL

YOUR chemical problems solved and working formulas furnished. Five dollars. Write me. W. Steiman Richards, Consulting Chemist, Box 2403, Boston, Massachusetts.

CHEMICAL pointers illustrated for six months and obtained right—fifty cents. The Wright Laboratory, Caldwell, New Jersey.

ENTER soap business, every person uses soap. Manufacture and distribute small batches at start, obtainable and material obtainable anywhere. One person can make two tons per day under this system. A sensible, sound, industry. Complete method \$3.00. Write now. Chester W. Johnson Co., 148 Dartmouth Street, Boston, Massachusetts.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

MANUFACTURING

WE manufacture anything, design and build special machinery, develop inventions, build models, make drawings of every description, our facilities the best. Write for booklet. R. G. Circa Engineering Co., St. Louis, Missouri.

TO order—Metal articles, models, tools, patterns, experimenting, manufacturing. Inventions developed. Cleveland Specialty & Manufacturing Co., Berea Avenue, Cleveland, Ohio.

ADDING MACHINES

FREE trial, marvelous new adding machine. Adds, subtracts, multiplies, divides automatically. Work equals \$250.00 machine. Price only \$15.00. Speedy, durable, handsome. Five-year guarantee. Used by largest corporations. Write to-day for catalog and free trial offer. Lightning Calculator Co., Dept. G, Grand Rapids, Mich.

BOATS AND LAUNCHES

MARK 10' runabout—Blueprint \$20c. Was-Roo-U Co., 41-6 West Market, Detroit, Michigan.

DOES IT PAY?

These Advertisers Say
"Yes."

Every week we receive letters from satisfied and successful advertisers who know that POPULAR SCIENCE MONTHLY PAYS. For that reason they continue to use it month after month, year after year. Their opinions are valuable to us—they should be to you. Why not profit by their experience and put YOUR advertisement where it will do the most good? Here are just a few remarks worth heeding:

"Our advertisement has proven very satisfactory and profitable." Betty Lee, Inc., New York.

"Our advertising in POPULAR SCIENCE MONTHLY has proven out very well indeed." Dodge's Institute, Valparaiso, Indiana.

"We carry several ads in your magazine and the results are satisfactory." C. T. Ludwig Corp., Kansas City, Mo.

"Our little ad in your magazine does its duty each month." Durkin-Krebs & Co., Pittsburgh, Pennsylvania.

There is no better time than now to start your campaign for MORE and BETTER business. 250,000 responsive readers are ready to heed your message if it is worthwhile. Why not start talking to them in the next issue? Forms close on the 5th of each month. Rate 25 Cents a Word—and cheap at that.

Classified Advertising Manager
POPULAR SCIENCE MONTHLY
225 West 39th Street
New York City

TELEGRAPHY

TELEGRAPHY—Morse and Wireless and railway telegraphy taught thoroughly. Big salaries, great opportunities. Oldest, largest school. All expenses low—can earn three part. Catalogue free. Dodge's Institute, Queen Street, Valparaiso, Indiana.

STAMPING NAMES

MAKE \$10.00 hundred stamping names on key checks. Send 25¢ for sample and instructions. PS Keying Company, Cohoes, New York.

QUICK profits with our Keycheck units. Jewel Keycheck Company, Shreve, Ohio.

FORMULAS

FREE—Formula catalog. Laboratories, 4800 Division Building, Chicago.

500 FORMULAS, realizing millions—increasing dry batteries—10 luminous paints, 25c. Ideal Book Shop, 5501-BP, North Halsted, Chicago.

3000 FORMULAS and recipes 400 pages, \$1.00. Englewood Book Shop, 7021 D South 56th Street, Chicago.

FORMULA catalog free. C. A. Luis, Apartment 241, York, Pennsylvania.

FORMULAS of the better sort. Write for our free catalog. National Scientific Laboratories, 645 Main, Hibbing, Minnesota.

"OPPORTUNITY KNOCKS." formulas for radio crystal and new cement. Electrical cement, particularly \$1.00. H. J. Davis, 43 Pier Street, Brooklyn.

3000 FORMULAS—358 pages, 50c. Ideal Book Shop, 5501-BP, North Halsted, Chicago.

RADIO SUPPLIES

ROTOR coils \$0.50; wound, with brass stems \$1.00. Variometers, varineuplers. Discounts to dealers. E. U. Black, Mir, Florence, South Carolina.

AMPLIFIER. Our one stage power tube amplifier when used in addition to the regular two stage amplifier will give surprising results, remarkably free from distortion. Write for descriptive matter of our one, two, and three-stage amplifiers. Central Mfg. Co., Fairfield, Iowa.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

MOTORCYCLES, BICYCLE, SUPPLIES

DON'T buy a bicycle motor attachment until you get our catalogue and price. Shaw Mfg. Co., Dept. 4, Galion, Ohio, Kansas.

PARTS for all motorcycle chaps. Brough Cycle Co., 1822 Westlake, Seattle, Washington.

USED and new parts. Indian, Excelsior, Harley, Reading, Thor, Henderson, Yale. Get our price lists. King-Holiday Cycle Co., 1156 North Kingshighway, St. Louis, Missouri.

LARGEST stock of new and used motorcycle parts and accessories in the world at your disposal via Uncle Sam's mail. Write for quotations. Motorcycle Parts Mfg. Co., 300-32 Wabash Avenue, Chicago, Illinois.

MOTORS, ENGINES, MACHINERY

FULLY-PAK grooved and metal belting spars, light transmission machinery. Send for catalog. Winfield H. Smith, 202 West Street, Buffalo, New York.

AMERICAN MADE TOYS

CARTING form for making metal walking bird whistles, \$1.00 complete. H. Smith, 214 Montebello Street, Trenton, New Jersey.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

AVIATION

PROPELLERS for aircraft propulation, 6-foot diameter, \$12. 8-foot for Perils, \$18; others in proportion. Biplane stretch blueprint, 75c. Peril size, \$1.00. Pictures free. Crawford Motor and Aeroplane, Long Beach, Calif.

BOYS build model aeroplanes at small cost. Write for circulars. Aero Shop, 3050 Huron Ave., Detroit, Michigan.

INVESTIGATE aviation information write for our free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch of invention for our opinion of its patentable nature. Highest references. Prompt service. Reasonable terms. Victor J. Evans & Company, 142 Ninth, Washington, D. C.

MODELS AND MODEL SUPPLIES

WE make working models for inventors and experimental work, and carry a complete stock of brass casts and model supplies. Send for catalogue. The Pierce Model Works, Tieley Park, Illinois.

MODEL making and experimental work; modern shop, expert workmen. Manufacturing Lampen Model and Experimental Works, 625 W. Jackson, Chicago.

PRACTICAL model steam engines, boilers, blowpipes, pumps. Send 10¢ to stamp for a new catalogue. Model Machine Shop Co., 417 East 71st Street, New York City.

MODEL steam engines, boilers, boats, model ship and boat fittings, model makers' supplies. Send 25¢ for new and enlarged Illustrated Catalogue and Handbook. Rathis Mfg. Co., Dept. C, 6215 Woodland Avenue, Philadelphia, Pennsylvania.

FOR THE HOME

GRANDFATHER clock works, \$5.00. Build your own case, instructions free. Make good profits selling your friends. Clock works with chimes for old or new cases. Write for full particulars. Clock Co., Nine Towns, Pennsylvania.

Quick-action advertisements continued on page 8



Be a Certificated Electrical Expert Earn \$3500 to \$10000 a Year In This Big Pay Field

TRAINED "Electrical Experts" are in great demand at the highest salaries, and the opportunities for advancement and a big success in this line are the greatest ever known.

"Electrical Experts" earn \$70 to \$200 a week. Fit yourself for one of these big paying positions. Big jobs everywhere are waiting for trained men to fill them.

Learn at Home to Earn \$12.00 to \$30.00 a Day

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But it's the trained man—the man who knows the whys and wherefores of Electricity—the "Electrical Expert"—who is picked out to "boss" ordinary Electricians—to boss Big Jobs—the jobs that pay. You, too, can learn to fill one of these jobs—spare time only is needed. Be an "Electrical Expert"—Earn \$70 to \$200 a week.

Age or Lack of Experience No Drawback

You don't have to be a College Man; you don't have to be a High School graduate. If you can read and write English, my course will make you a big success.



It is the most simple, thorough, and successful Electrical Course in existence, and offers every man, regardless of age, education, or previous experience, the chance to become, in a very short time, an "Electrical Expert," able to make from \$70 to \$200 a week.

I Give You a Real Training

As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training a man needs to get the best positions at the highest salaries. Hundreds of my students are now earning \$1,500 to \$10,000 a year. Many are successful ELECTRICAL CONTRACTORS. Every branch of Electricity is open to you when you have finished my course. My experience as a practical engineer and my most unusual course makes this possible. I even have special lessons for those who want to go into business for themselves.

Some Features of My Course That Make SUCCESS Certain

- Home Study Training Revolutionized**
- 1. Practical Money-Making Instruction—in plain, high-sounding terms.
- 2. Free Electrical Outfit—Finest outfit ever sent out for home experiments and practical use.
- 3. Free Employment Service. (Helps you get a good job.)
- 4. Free Consulting Service. (No chance to get stuck on anything while studying or afterward.)
- 5. Free Engineering Magazine.
- 6. Free use of my Electrical Laboratory.
- 7. Extra Course—Free—Radio—Electrical Drafting.
- 8. Spare Time Work—Special earn-while-you-learn lessons.
- 9. Reduced prices on all Electrical Supplies.
- 10. Cash Refund Guarantee Bond.

These features are all explained in my big Free Book.

I give each student Outfit of Electrical Tools, Materials and Measuring Instru-

ments absolutely FREE. I also furnish them with all supplies, including examination paper, and many other things that other schools don't furnish. You do PRACTICAL work—AT HOME with this outfit. You start right in after the first few lessons to WORK AT YOUR PROFESSION in a practical way.

You Owe Yourself the Best Why Not Get It?

To make yourself the big success you want to be—to get the big money and make a name for yourself—you need the best training you can get. Get it right here—Now—Where results are guaranteed.

Get Started Now—Mail Coupon



I want to send you the "Vital Facts" of the Electrical Industry, including my Electrical Book, Proof Lessons, and a sample of my guarantee bond all FREE. These cost you nothing and you'll enjoy them. Make the start today for a bright future in Electricity. Send in the coupon—NOW.

**L. L. COOKE, Chief Engineer
Chicago Engineering Works**

Dept. 38
2150 Lawrence Ave. Chicago, Ill.

L. L. COOKE, Chief Engineer Chicago Engineering Works
Dept. 38, 2150 Lawrence Ave., Chicago, Ill.

Dear Sir:—Send at once the "Vital Facts" containing Sample Lessons, your Big Book, and full particulars of your Free Outfit and Home Study Course—all fully prepaid, without obligation on my part.

Name

Address

The "Cooke" Trained Man is the "Big Pay" Man

LETTER SPECIALISTS

BETTER business letters! Make busy men take notice. Letters written—processed—mailed. Harvey Letter Service, Brewton, Alabama.

FOR BOYS

MOUTH-ORGAN Instructor, \$25. Play in one hour. Elmer Publisher, Bowling Green, Ohio.

ASTROLOGY

MAGIC words! Secret, sure method of obtaining your desires. Postpaid for dime. Astrology, 143 Miller, Brooklyn, New York.

ASTROLOGY revealed—2000 word trial reading. \$25. two questions free. State birth date. Prof. Astrol, Dept. P, Box 824, Washington, D. C.

OFFICE DEVICES

ADDRESSING machines, multigraphs, duplicators, folders, check writers, sealers, dictating machines, at about half new cost. Profit, 170-2 North Wells, Chicago.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 223 West 29th Street, New York.

MISCELLANEOUS

HAROLD Blade Pocket Knife—Money easy cards by sending a handle for an old discarded safety blade. Sample mailed to address on receipt 25¢ each or stamp. A. Tolson & Company, 66 Plummer, Hammond, Indiana.

STAKE interested new friends through Jolly Letter Seal and Stamp. Betty Lee, Incorporated, 4234 Broadway, New York City.

DUBBELL stamps. Your name and address, 25¢. Dubbell Stamp Shop, Munster, Indiana.

ALCOHOL book \$2. Formulas free. \$25.00, 100 bottles. Copper kegs. E. Corn Bus 2571, Boston.

STOLEN auto. make this device yourself at home in few minutes, attach to auto and prevent thief. Drawings and instructions for making \$1.00. Tanglewood Supply Company, Muscatine, Iowa.

ADVERTISING

PUT your advertising problems up to those who know. As president of the advertising agency of Douglas Wakefield Creative, Inc., New York, I have conducted campaigns for many of the national advertisers of America. What I have done for others I can do for you. And by doing it in our spare time you'll get maximum results at minimum cost. Letters, folders, booklets, advertisements written and illustrated. Explain your needs in first letter. Reference—R. G. Davis, any magazine or newspaper. Address: Douglas Wakefield Creative, Suite Park Avenue, Woodfield, New Jersey.

FREE AD-Cards giving interesting rates for advertising in magazines and weeklies. Concordia Magazine, 211 W. York, Pennsylvania.

ADVERTISE in 24 metropolitan dailies, 25 words, \$15. National Register listing 1600 publications, 4¢ stamp. Wade, 101 Union Ridge, Chicago.

INCH Display advertisement, 161 magazines, three \$15.00. Wood's Popular Services, Atlantic City.

ADVERTISING letters, booklets, circulars composed. Quinn, 6644 Lansdowne Avenue, Philadelphia.

ADVERTISING in 100 magazines, as word, \$2.00 each. Womershaw, 2433 Robertson, Cincinnati, Ohio.

WORK WANTED

PUNCH from work, tool and die making model, and special machine work wanted. Completely equipped with new machinery of the latest type. Prompt delivery, reasonable prices guaranteed. Quality & Machine Co., Dept. R, 8134-36 N Clark St., Chicago.

SCENERY FOR THEATRE

SCENICAS for opera, drama, minstrels. Photo drama. Address: Dennis, 1000 Madison, Milwaukee.

TYPEWRITERS AND SUPPLIES

TYPEWRITERS—all makes, \$15.00 up. Guaranteed five years, one month's free trial. Special proposition to agents. Send for catalogues before purchasing. Typewriter Manufacturers' Exchange, Fordham, New York.

PRINTING, ENGRAVING, MULTICRAPHING

LETTERHEADS, envelopes, 300 to 500. Samples free. Quality Printer, Marietta, Ohio.

100,000 1 x 2" labels \$22.00. 1,000, 25¢. Env. 20¢. Wolf Labels, Station K, Philadelphia.

BETTER printing for less money! Send for our large package of samples of hundreds of items every user of printing is interested in. These samples worth dollars will be sent for 10 cents to pay postage. Ernest Faustus Company, 1115 South Dearborn Street, Chicago.

IMPROVED business, personal stationery. Samples, stamp. Daniels P. Company, Pittston, Pennsylvania.

LOWEST prices on advertising. Penels in quantity. Sample with your Ad imprinted in gold, 10¢. A. Mutual Co., 425 Walnut Street, Yonkers, New York.

500 TWO-COLOR letterheads, \$2.00. Samples free. Advertiser, Station C-5, Milwaukee.

500 LETTER heads or envelopes, \$2.00. Royal Printing Company, Post Falls, Idaho.

POULTRY AND LIVE STOCK

BREED swine. Book free. C. Rice, Nelson Highbank, 77, Marionville.

SPENCE turkeys—half turkey, half chicken. Photos, booklet, free. Spence, R. L., Santa Cruz, California.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 223 West 29th Street, New York.



See How Easy It Is To Learn Music This New Way

YOU know how easy it is to put letters together and form words, once you have learned the alphabet. Playing a musical instrument is not very much different. Once you learn the notes, playing melodies on the mandolin, piano or violin is simply a matter of putting the notes together correctly.

The first note shown above is F.

Whether you are singing from notes, playing the piano or banjo or any other musical instrument, that note in the first space is always F. The four notes indicated are F, A, C, E, easy to remember, because they spell the word "face." Certain strings on the mandolin, certain keys on the piano, represent these same notes—and once you learn them, playing melodies on the instrument is largely a matter of following the notes.

Anyone can now learn to play a musical instrument at home, without a teacher. A new simplified method of teaching reduces all music to its simplest possible form. You can now master singing, piano-playing, or any musical instrument you wish right at home, quickly, easily, without endless study and practice.

Practice is essential, of course—but it's fun the new way. You'll begin to play melodies almost from the start. The "print and picture" method of self-teaching

is fascinating; it's simply a matter of following one interesting step after another. You learn that the note in the first space is F, and that a certain key on the piano is F. Thereafter you will always be able to read F and play it whenever you see it. Just as you are able to recognize the letters that make a word, you will be able to recognize and play the notes that make a melody. It's easy, interesting.

You don't have to know anything whatever about music to learn to play a musical instrument this new way. You don't have to pin yourself down to regular hours, to regular classes. You practice whenever you can, learn as quickly as you please. All the intricate "mysteries" of music have been reduced to a method of amazing simplicity—each step is made as clear as ABC. Thousands have already learned to play their favorite musical instruments this splendid new quick way.

You Can Play Your Favorite Instrument Three Months From To-Day

If you are dissatisfied with your present work, let music act as a stepping-stone into a new career. If you long for a hobby, a means of self-expression, let music be the new interest in your life. If you

wish to be a social favorite, if you wish to gain popularity—choose your favorite instrument and, through the wonderful home-study method of the U. S. School of Music, play it three months from to-day.

You can do it. Youngsters of 10 to 12 years have done it, and men as old as 60 have found new interest and enjoyment in learning how to play a musical instrument. You don't have to listen while others entertain any longer. YOU can be the center of attraction, the talented person who holds the audience fascinated.

Is it the piano you wish to play, the mandolin, the violin, the saxophone? Do you want to learn how to sing from notes? Are you eager to be able to play jazz on the clarinet, the banjo?

Free Book Explains New Method

It costs you nothing and obligates you in no way whatever to send for our free book called "Music Lessons in Your Own Home." Everyone who is interested in music should send at once for this valuable book. It not only explains the wonderful new simplified method of learning music, but tells about a special short time offer now being made to music-lovers.

Mail this coupon at once for your copy. Remember, it obligates you in no way whatever—it's free. But act now before the supply is exhausted. U. S. SCHOOL OF MUSIC, 414 Brewster Street, New York.

U. S. SCHOOL OF MUSIC

414 Brewster Street, New York City

Please send your free book, "Music Lessons in Your Own Home," and particulars of your Special Offer. I am interested in the following courses:

(Name of instrument or course)

Name _____ (Please Write Plainly)

Address _____

City _____ State _____

Big Jobs Open
Auto Repair, Walking Shoes, Furniture, Books, for Auto men. We conduct road trained men right away and they know where to look for them.

Railroad Fare and Board FREE

In order to fill these openings of ours I am making an offer no one has ever made before. I cannot hold this open long. I'd tell you about it in my letter. Send for details and Big Free Book on Auto Business. Write before it's too late.

RANE AUTO & TRACTOR SCHOOL
Dept. 2873 644-B Grand Ave., Chicago,
Illinoian and Wilson, Chicago, Ill.

"STAMMERING"

Its Cause and Cure

You can be quickly cured if you stammer. Read 30 cents, cash or stamp, for 250 page cloth bound book on Stammering and Scattering. It tells how I cured myself after Stammering and Scattering for 20 years. BENJAMIN H. BOGLE, 657 Superior Bldg., 116 W. 8th St., Indianapolis.

MAKE MONEY AT HOME

YOU can earn from \$1 to \$2 an hour in your spare time writing show cards. Quickly and easily learned by our new simple "Instructograph" method. No canvassing or soliciting; we teach you how, guarantee you steady work at home no matter where you live, and pay you cash each week. Full particulars and Booklet Free.

AMERICAN SHOW CARD SCHOOL

204 Ryrie Building, Toronto, Canada

Quick-Action Advertisements continued on page 10



"We pay him \$100 a week"

AND he's worth every cent of it. Came here several years ago asking for a job. He got just that—a small job at a small salary.

"Then I forgot about him—hardly knew he was on the payroll until one day I got a letter from the International Correspondence Schools telling me that Thomas A. Andrews had enrolled for a course and had received a mark of 98 for his first lesson.

"There's a man worth watching," I said to myself, so I began to keep tabs on his work. Pretty soon he began coming to me with suggestions. I could almost see him growing.

"Somehow he was the first man I thought of whenever there was a position open. And he always made good because he was always preparing himself for the job ahead. We pay him \$100 a week now and he's going to be earning even a larger salary some day. I wish we had more men like him."

HOW do you stand when your employer checks up his men for promotion? Does he think of you? Is there really any reason why you should be selected?

Ask yourself these questions fairly. You must face them if you expect advancement and more money. For now, more than ever, the big jobs are going to men with special training.

There is an easy, fascinating way for you to get this special training right at home in spare time. One hour a day, spent with the I. C. S. in the quiet of your own home, will bring you more money, more comforts, more pleasures, all that success means.

AN I. C. S. course is not a sure guarantee of a larger salary, but it comes as near to it as anything we know. Certainly the man who studies in his spare time is more certain to get ahead than the man who just drifts along.

Every mail brings letters from I. C. S. students telling of advancements and increased salaries won through spare-time study. In a single year, the increases voluntarily reported by I. C. S. students totaled more than \$2,000,000.

These advancements and increases in salary were not only in the technical subjects such as Electrical, Mechanical and Civil Engineering, Architecture, Chemistry, etc., but in Salesmanship, Advertising, Business Management, Accounting, etc.

Whatever the course, if it is an I. C. S. course, you can be sure it represents the best thought of men who are leaders in that field and is drawn from their practical experience.

Is there any reason why you should stand still while others are proving every day that you can get ahead if you

really want to? Don't you feel that you should at least find out what the I. C. S. can do for you?

YOU can have the position you want in the work you like best—a salary that will give you and your family the home, the comforts, the pleasures you would like them to have. No matter what your age, your occupation, your present education, or your means, you can do it.

Just mark and mail this coupon, and, without cost or obligation, get full particulars telling how you can prepare for success in the work of your choice.

INTERNATIONAL CORRESPONDENCE SCHOOLS Box 7468-C, Scranton, Penn.

Without cost or obligation on my part, please tell me how I can qualify for the position of in the subject during which I best succeed in.

BUSINESS TRAINING DEPARTMENT

- Business Management
- Industrial Management
- Personnel Organization
- Traveling Salesman
- Personal Law
- Banking and Banking Law
- Accountancy including C.P.A.
- Automobile Cost Accounting
- Bookkeeping
- Office Secretary
- Domestic Spanish
- French

TECHNICAL AND INDUSTRIAL DEPARTMENT

- Electrical Engineering
- Electric Lighting
- Mechanical Engineer
- Mechanical Draftsmen
- Machine Shop Practice
- Blue and White Prints
- Gas Engine Overhauling
- Metal Worker
- Surveying and Mapping
- Metallurgy
- Steam Engineering
- Radio
- Architects
- Civil Engineering
- Contractor and Builder
- Architectural Draftsman
- Concrete Worker
- Structural Engineer
- Chemistry
- Automobile Work
- Automobile King Work
- Agriculture and Pasture
- Mathematics

Name _____

Street Address _____

City _____ State _____

Date _____

Occupation _____

Persons residing in Canada should send this coupon to the International Correspondence Schools Committee, Montreal, Quebec, Canada.

The Magic Power that Enables Men to do the "Impossible"

It Lies Dormant in Everyone. Awake It and You Instantly Release a Great and Entirely Unsuspected Money-Making Power

WHILE the whole world held its breath, Blondin, the famous French acrobat, got up from a sick bed, and calmly pushed a wheelbarrow carrying a man over Niagara Falls on a tight-rope. Against the wild protestations of his physicians, he performed a feat that everyone said was "impossible."

Grant, after suffering defeat and humiliation, and confronted with every conceivable obstacle, spent months of apparently hopeless work trying to capture the fortress at Vicksburg. Everything was against him. His efforts were laughed at. It was "impossible" they said. Yet the fortress finally surrendered to him, and he was crowned with glory.

Columbus—alone on the vast expanse of the Atlantic Ocean—surrounded by a gang of murderous mutineers—achieved the "impossible" when he rekindled confidence in the hearts of his men, made them eager to obey, and sailed on and on until he discovered a New World.

Pizarro, the Spanish adventurer in his quest of the riches of Peru, was left on the small island of Gallo with but thirteen followers and no provisions. They suffered deprivation and torture of every kind. The one hope lay in turning back to Panama—but Pizarro, tracing a line in the sand with his sword said, "Friends and comrades, on this side (the South) are toll, hunger, nakedness, the drenching in rain, repetition and death; on this side (the North) ease and pleasure. There lies Peru with its riches; here Panama and its poverty. Choose, each man, what best becomes a brave Castilian. For my part, I go to the South." He stepped across the line and his men followed him—to success.

Wright achieved the "impossible" when he proved that men could fly in the air. Washington achieved the "impossible" when with his handful of ragged, half-starved soldiers he defeated the strong, well-armed British. Justice achieved the "impossible" when he stemmed the German onslaught at the Marne. History is filled with similar examples of how men hopelessly handicapped and in the face of unsurmountable obstacles, have gone ahead and accomplished the "impossible."

The Sleeping Giant Within You

What is the power that lies back of these almost superhuman achievements? Is it something that is possessed only by a few chosen individuals? No. It is a power that lies within you—and within everyone. In most of us, however, it is dormant. It is a sleeping giant, which, when aroused to action can perform deeds that are almost God-like in their wonder. Yet most of us do not even suspect its existence!

The thing that has carried all great men of history to success—the thing that's responsible for every great fortune in the world—the thing that lies back of every great achievement is simply **Will Power**.

In achieving success—in making money—a strong, indomitable Will can do more for you than any faculty you possess.

No matter what circumstances are against you, no matter how "impossible" achievement may now seem—you can achieve the success you have always hoped for—you can increase your earning power—if you only WILL to do so!

The whole thing is ridiculously simple. Take any successful man. Compare him with yourself. You will find that you and he are pretty much the same. Your appearances may differ. Your habits may differ. But fundamentally, you are both very much alike. He has succeeded in a big way—and you haven't. What is the answer?

The true answer—the answer which you know to be true, yet which is hard to admit—is that he had the *will* to push himself ahead and win—and you hadn't. It was hard for you to get started because getting ahead looked "impossible." You were perhaps afraid you wouldn't make good. You were afraid you would get in hot water. And while you were holding back, actually looking for obstacles as an excuse, the successful man, with no more intelligence than you, pushed ahead and won.

Acquire a strong inflexible Will, and nothing will be too big for you. With a strong Will you can brook aside every obstacle and like Grant, Columbus and Pizarro, achieve the "impossible." With a properly trained Will and average intelligence—that is a just average indeed—not you can increase your earnings to a really astonishing degree. You've got to succeed—you can't help succeeding.

This Amazing Power Can Now Be Yours

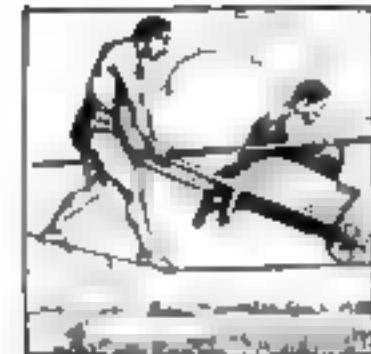
But you ask, can one really increase his will power—and if so, does it not mean a long hard period of training? There is a way—a sure, certain way—of developing a powerful Will. And instead of being a difficult process, it is fascinatingly interesting. It is through Prof. Frank Channing Haile's world-famous book "Power of Will." Over three million people it is estimated have benefited through the money-making, success-building knowledge contained in this remarkable book. Through it thousands of men and women have been able to go in business for themselves, and make more money than they ever thought possible. Through it, thousands have doubled—and even trebled—their wages in an amazingly short time. Salary increases of from \$15 above \$25 a week to over \$200 a week are not at all unusual!

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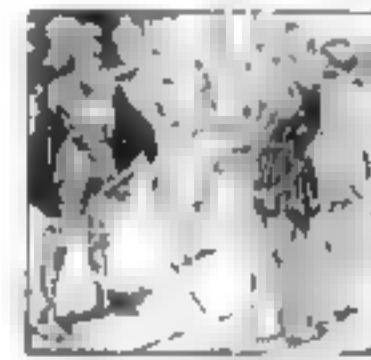
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and I offered you something that would give you ten years more to live, would you take it? You'd grab it. Well, believe it or not, I can do that. I don't want all you're dying or it won't do you a bit of good. It will then be too late. Right now is the time. To-morrow or day after some disease will get you and if you have not equipped yourself to fight it off you're gone. I don't know of any disease that isn't a medical doctor but I put you in such phobia that he Doctor will start to fight, waiting for you to take him. For you might be suspicious trying to kill a brick wall. A big chance.

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When I'm through with you, you're a real man. The kind that men prove it. You will be able to do things that you didn't thought impossible. Your deep full chest, heart, etc., it gives air circulating your blood and making you look healthy over with a man and healthy. Your huge square shoulders and you massive muscular arms have that craving for the exercise of a real man. You have the flesh to you, eye and the pep to your step that will make you brilliant and sought after in both the business and social world. This is no idle promise. Believe it. If you doubt me, make me prove it. We should. I like it. I have already done this for thousands of others and the records are unchallenged. What I have done for them, I will do for you. I mean them. The one day and every day comes. Let this very day be the beginning of new life to you. BEND FOR MY BOTTLE.

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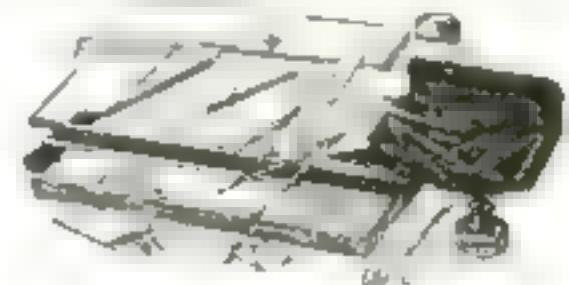
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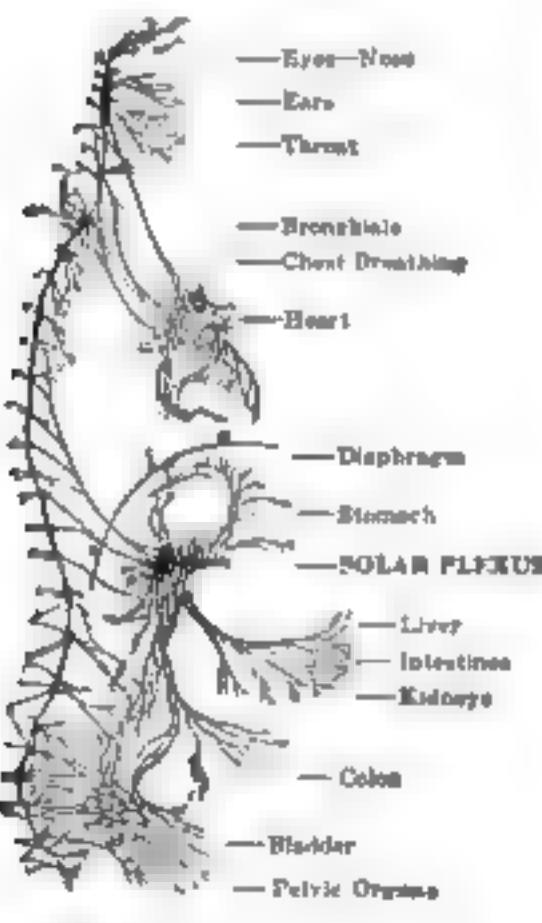
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"NERVES"

A Subtle and dangerous malady which is undermining the vitality of the American Nation

By PAUL von BOECKMANN

"NERVES"—We hear it everywhere. The physician tells his patient "It's your Nerves"; sensitive and high-strung women complain of their "Nerves." You see evidence of "Nerves" everywhere—in the street, in the cars, in the theatre, in business, and especially in your own home—right in your own family. We Americans are a nation of nervous people. This is known the world over. Our own Nerve Specialists admit it. It is caused by our "Nile-a-minute" life; the intenseness of our Natures in everything we do. It is making us the most progressive nation on earth but it is also wrecking our people. Our enemies prove it. Mental records prove it. Millions of people have subnormal Nerve Force, and consequently suffer from endless organic and physical troubles, which make their lives miserable. What is meant by "Nerves?" By "Nerves" is meant Nerve Exhaustion (Neurasthenia), lack of Nerve Force. What is Nerve Force? We might as well ask, "What is electricity?" We do not know. It is the secret of Nature. We do know that it is the vital force of life, a mysterious energy that flows from the nervous system and gives life and energy to every vital organ. Sever the nerve which leads to any organ and that organ will cease acting.



The Sympathetic Nervous System

Showing how Every Vital Organ is governed by the Nervous System, and how the Solar Plexus, commonly known as the Abdominal Brain, is the Great Central Station for the distribution of Nerve Force.

The wonderful organ we term the Nervous System consists of countless millions of cells. These cells are reservoirs which store Nerve Force. The amount stored represents our Nerve Capital. Every organ works incessantly to keep the supply of Nerve Force in these cells at a high level for Life itself depends more upon Nerve force than on the soul we are or even the air we breathe.

If we unduly tax the nerves through overwork, worry, excitement, or grief, if we subject the muscular system to excessive strain, or in any way consume more Nerve Force than the organs produce, the natural result must be Nerve Bankruptcy. In other words, Nerve Exhaustion, Neurasthenia, or Nerves. There is but one maddeningly more terrible than Nerve Exhaustion—

its kin, Insanity. Only those who have passed through a siege of Nerve Exhaustion can understand the meaning of this statement. It is HELL, no other word can express it. At first, the victim is afraid he will die, and, as it grips him deeper, he is afraid he will not die—so great is his mental torture. He becomes panic-stricken and irresolute. A sickening sensation of weakness and helplessness overcomes him. He becomes obsessed with the thought of self-destruction. Nerve Exhaustion is not a malady that comes suddenly. It may be years in developing and the decline is accompanied by unmistakable symptoms, which can readily be recognized.

The symptoms of Nerve Exhaustion vary according to individual characteristics, but the development is usually as follows:

FIRST STAGE: Lack of energy and endurance; that "tired feeling" especially in the back and knees.

SECOND STAGE: Nervousness; sleeplessness; irritability; depression; loss of hair, nervous and gassy bowels; stomach gas; bowel constipation; irregular heart; poor memory; lack of mental endurance; dizziness; backache; headaches; neuritis; rheumatism; and other pains.

THIRD STAGE: Serious mental disturbances, fear, anxiety, worry, hallucinations, dangerous organic disturbances, suicidal tendencies, and, in extreme cases, insanity.

How often do we hear of people running from doctor to doctor seeking relief from a mysterious compelling the matter with them, through repeated examinations and to show that the particular organ is weak or damaged? How often do we hear of people tracking their brains trying to discover the reason of their failure in business, in a profession, love, or any undertaking? They would give anything to lay their finger on the stumbling block of their lives—the door that locks out their ambitions, the wall that blocks their progress. The answer is—lack of Nerve Force. In short, Nerve Force means Life Force, Brain Force, Vital Force, Organ Force, Dynamic Force, Personal Magnetism—Magnetism and Womanliness.

No man WITH Nerve Force has ever stood in a bread line.

No man WITH Nerve Force has ever been down and out.

No man WITH Nerve Force has ever acknowledged himself failed.

No man WITH Nerve Force has ever failed to attain success.

This of course applies to women as well as men. And, on the other hand, WITHOUT Nerve Force no person of either sex in any walk of life has ever reached the top, has ever achieved success, or has ever gotten the fullest enjoyment from life itself. WITHOUT an abundant supply of Nerve Force our lives are wrongly directed; we fail to utilize our full powers, and we cheat ourselves of our birthright of health and vigor.

"A sound mind in a sound body depends upon sound nerves. And to be a WINNER even in a small way demands first of all—NERVE FORCE. If your NERVES have reached any of the three stages of depletion you ought to take immediate steps to determine the cause and to learn what to do to build up your Nerve Force."

I have made a life study of the mental and physical characteristics of nervous people having treated more cases of Nerves during the past 25 years than any other man in the world (over 90,000). My instruction is given by mail only. No drugs or drastic treatment of any kind are employed. My method is remarkably simple, thoroughly scientific and always effective. I shall agree to send you further information regarding my system of treatment FREE and without any obligation on your part. Everything is confidential and sent sealed in a plain envelope.

You should read my 64-page book, "NERVE FORCE". The cost of this book is only 25 cents (coin or stamps). The book is not an advertisement of any treatment I may have to offer. This is proved by the fact that large corporations have bought and are buying this

book from me by the hundreds and thousands for circulation among their employees. Efficiency. Physicians recommend the book to their patients. Ministers recommend it from the pulpit—Nerve Control. Happiness. Never before has so great a mass of valuable information been presented in so few words. It will enable you to understand your Nerves, your Mind, your Emotions and your Body for the first time.



PAUL von BOECKMANN

Author of "NERVE FORCE" and a host of other books on Health, Physical Training, Breathing, Hygiene and Kindred subjects. Here is a portrait of his famous book. It has been sold out of the last 3 years.

Paul von Boeckmann is the scientist who explained the nature of the mysterious "Gas-Breath" disease involved in the Coulon-Abbott Feats, a problem that had baffled the leading scientists of America and Europe for more than thirty years, and a full account of which has been published in recent issues of *Physical Culture Magazine*.

Read the book at my risk that is, if it does not meet with your highest expectations, I shall refund your money. Price \$1.00, your outlay for postage. My advertisements have been appearing in this and other papers I might name for past 20 years. This is ample evidence of my integrity and responsibility.

The following extracts are quoted from letters written by people who have read the book:

"I have gained 12 pounds after reading your book and I am now 160 lbs., too heavy, I am up to 160 lbs. I have lost 10 lbs. in weight since reading the book."

"I have been treated by a number of nerve specialists and have travelled all over the country in an endeavor to test the my system to Hospital. I am not able to find any one for the truth of other methods compared."

"Your book did more for me for indigestion than two doctors did."

"My heart is now regular again and my nerves are fine. I thought I had heart trouble but it was simply a case of indigestion. Better. I have reread your book at least ten times."

"A woman writes: Your book has helped my nerves wonderfully. I am sleeping so well and in the morning I am so rested."

The advice given in your book on relaxing and calming of nerves has cleared my brain. Before I was half crazy all the time."

A physician says: Your book shows you have scientific and profound knowledge of the nerves and nervous people. I am recommending your book to my patients."

A prominent lawyer in Atlanta, Georgia says: Your book saved me from a nervous collapse such as I had three years ago. I can sleep soundly and am gaining weight. I can live a normal day's work."

PAUL von BOECKMANN,

110 West 40th St., Studio 167, New York, N. Y.

Dear Sir: I desire to investigate your method without obligation of any kind. Print name and address plainly!

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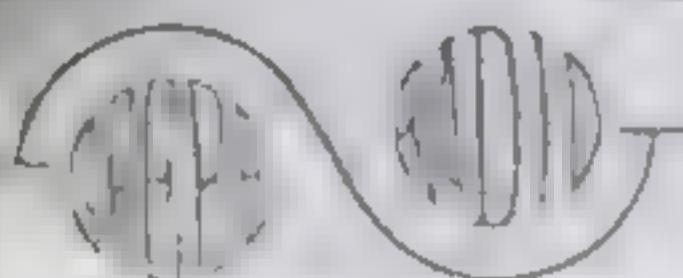
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Doctor Hu





POPULAR SCIENCE MONTHLY

November 1922

How Thrilling New Sport of Aerial Yachting May Develop from Recent Sailplane Contests

Famous Airman Predicts Astounding New Era of Popular Flight



In the following article, Augustus Post, leading American aeronautic expert, discusses the amazing future of soaring flight, on reviewing still the records made by German kite-plane pilots in the Rhön valley, a few weeks ago.

Glenelg has been one of the first on this side of the Atlantic to follow up the German exploits, and Mr Post's vision of the possibilities of the Curtiss seaplane is

pilot red above. He believes the Navy may take over for training purposes of the planes launched from Holt ships and fitting them out with cameras in their wings. That makes my planes a bit twisted by a wind of like sort & I am not at all satisfied with parts for the cameras of greater size than finally fit upon a propeller as it is caused or caused by a great power boat until it runs speed enough to rise and gain

By Augustus Post
Secretary, Aero Club of America

MAN has never really flown, he has only made machines that fly. From the time when the Greek myths told how Icarus, who went near the sun that the warmth of his wings was melted, to the time that Leonardo da Vinci, the greatest of all early inventors, drew plans for a flying machine, men have tried to say if man could fly. The first record of man's attempt at flight is in the story of Icarus. In the eighteenth century, when the first experiments at Kitty Hawk began, Man had still not learned to fly. When the Wright brothers began their experiments at Kitty Hawk, they were the first to learn to fly.

When a few weeks ago the young German sailplane pilot, H. P. Hartung, soared in a ~~motorless~~ sailplane high over the German countryside at Gersfeld in the Rhön mountains, remaining aloft



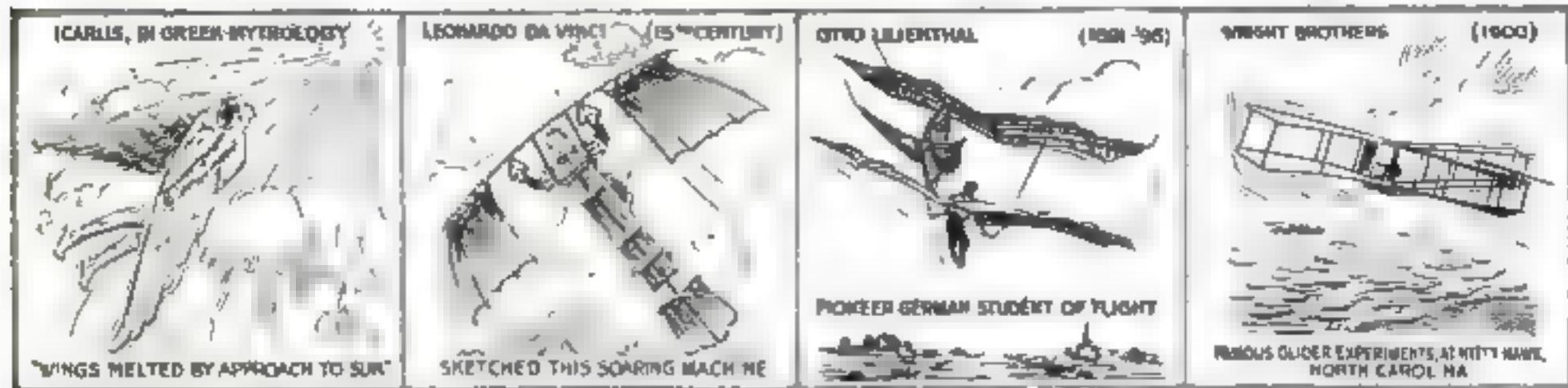
Augustus Post in the car of the balloon, "New York," at 10,000 feet, during flight that established duration record of 48 hours, 26 minutes. (See note, page 27.)



Gunn H. Curtiss, inventor of the flying boat and father of the modern aircraft industry, died yesterday at his home in Glendale, Calif., at the age of 75. He was born in 1878 in Waukegan, Ill., and died in his sleep.

For the first time in his life he had a real purpose. He had a definite goal to work toward. He had a definite task to perform. He had a definite responsibility to fulfill. He had a definite mission to accomplish. He had a definite purpose to serve. He had a definite task to perform. He had a definite responsibility to fulfill. He had a definite mission to accomplish. He had a definite purpose to serve.

The Evolution of Flight - From Dreams of Birdlike Soaring,



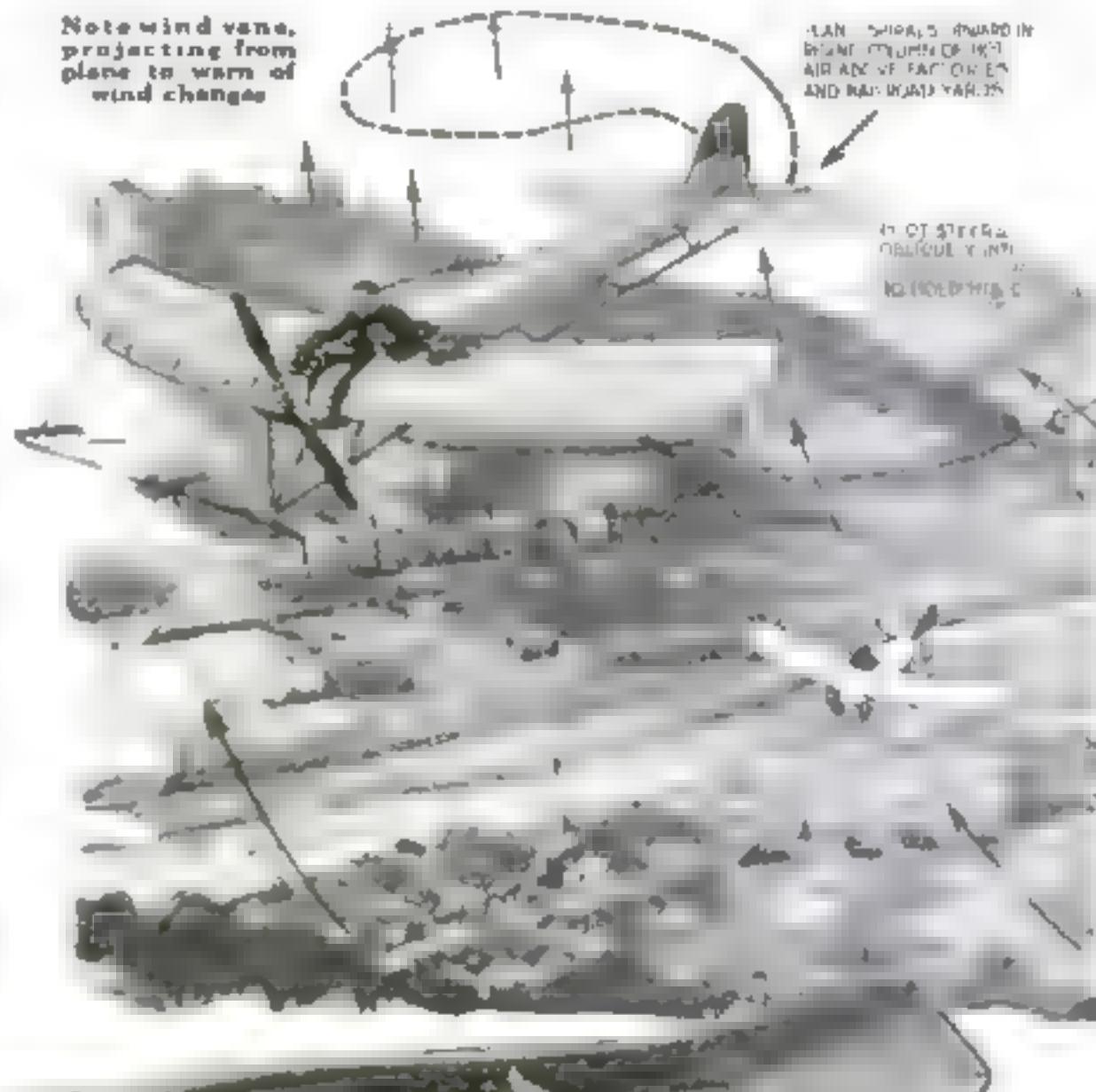
fast train to travel from Albany to New York City. And he landed more than 1100 feet above his starting point!

Only a few years ago the feat of remaining aloft for a few moments, after gliding downward from the top of a high hill, was considered remarkable. Soaring for a quarter of an hour, last year in Germany, was thought amazing; but this year the young technical students, Hentzen, Johann Martens, and others, climbing and hovering like birds for hours instead of minutes during the Rhön contests, have simply staggered us.

Air Yachting as Popular Sport

I doubt whether the public fully realizes just what these epoch-making adventures of 1922 mean to aviation. To my mind, they mean that the science of aviation begins all over again; and this time anybody will have as good a chance to own a flying machine and to run it himself as he now has to own and run an automobile. I, for one—looking ahead to the day when, with light motors added to these revolutionary sailplanes, there will be perfected a flying craft costing little more than an automobile—risk the guess that flying will become a popular health-giving sport. While not so common as motoring perhaps, this thrilling sport will be much more common than yachting, for the yachtsman must live by sea or lake, while the flyer finds the air and winds everywhere.

Giders, as now developed, are small motorless airplanes—either monoplanes, biplanes, or multiplanes—made of light wood, metal and cloth. The ingenious new seagoing sailplane recently perfected and successfully tested by Glenn H. Curtiss, pioneer of commercial avia-



Note revolving "football," replacing wheels or skids for landing

tion in America, has a hull of duralumin, a metal more than twice as strong and as light as aluminum. In some types of sailplanes the pilot sits in the fuselage or body, as in the cockpit of an airplane; in others he sits in a seat beneath the wing. In each case he operates rudder, ailerons, and elevators as in an airplane, and in some machines even the wings may be adjusted by the pilot to gain a better balance for the machine.

The record breaking "air yacht" Vampyr, used by the students Hentzen and Martens at Gersfeld, resembles in the air a

huge, ungainly, angular seagull. In structural detail the single deck plane is closely modeled after soaring and skimming birds. Extreme curvature of the wings gives remarkable lifting power at low speeds, while the ends of the wings consist of warpable surfaces, controlled from the pilot's seat, by means of which the tapering wings are instantly adjusted to varying air currents.

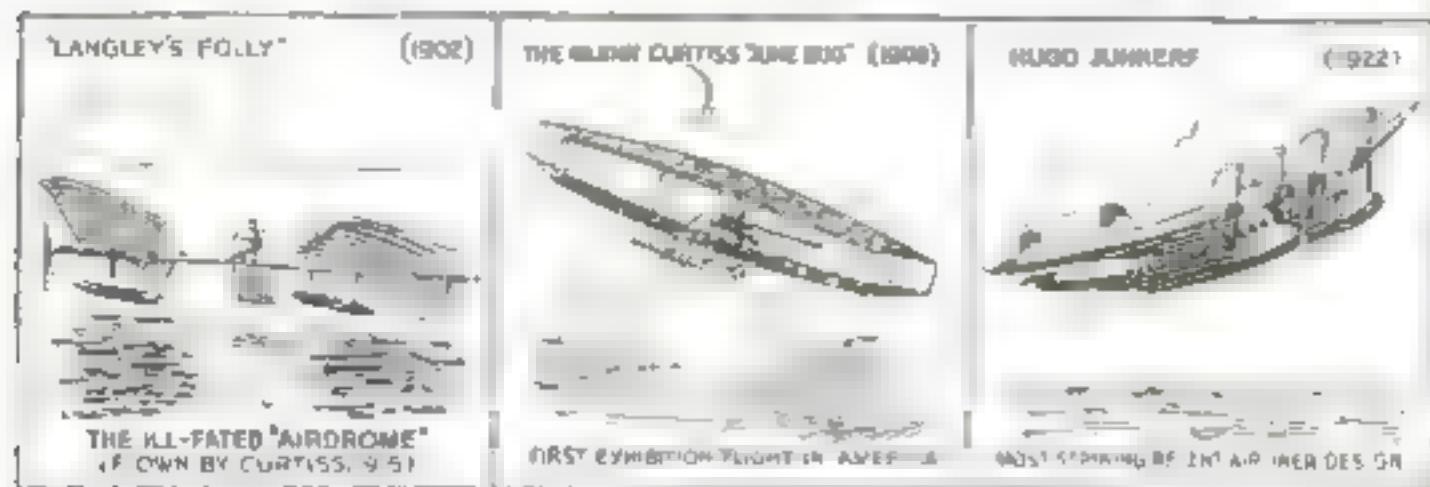
To decrease wind resistance, the pilot is enclosed in the streamlined fuselage, which terminates in a steering tail. Only his head is exposed. The center of the wings, just above the pilot, is often curved to an arch,

At left the "seagull" sailplane with which Hentzen and Martens established world's records in recent soaring contests at Gersfeld, Germany. Hentzen peers from the fuselage which encloses his body

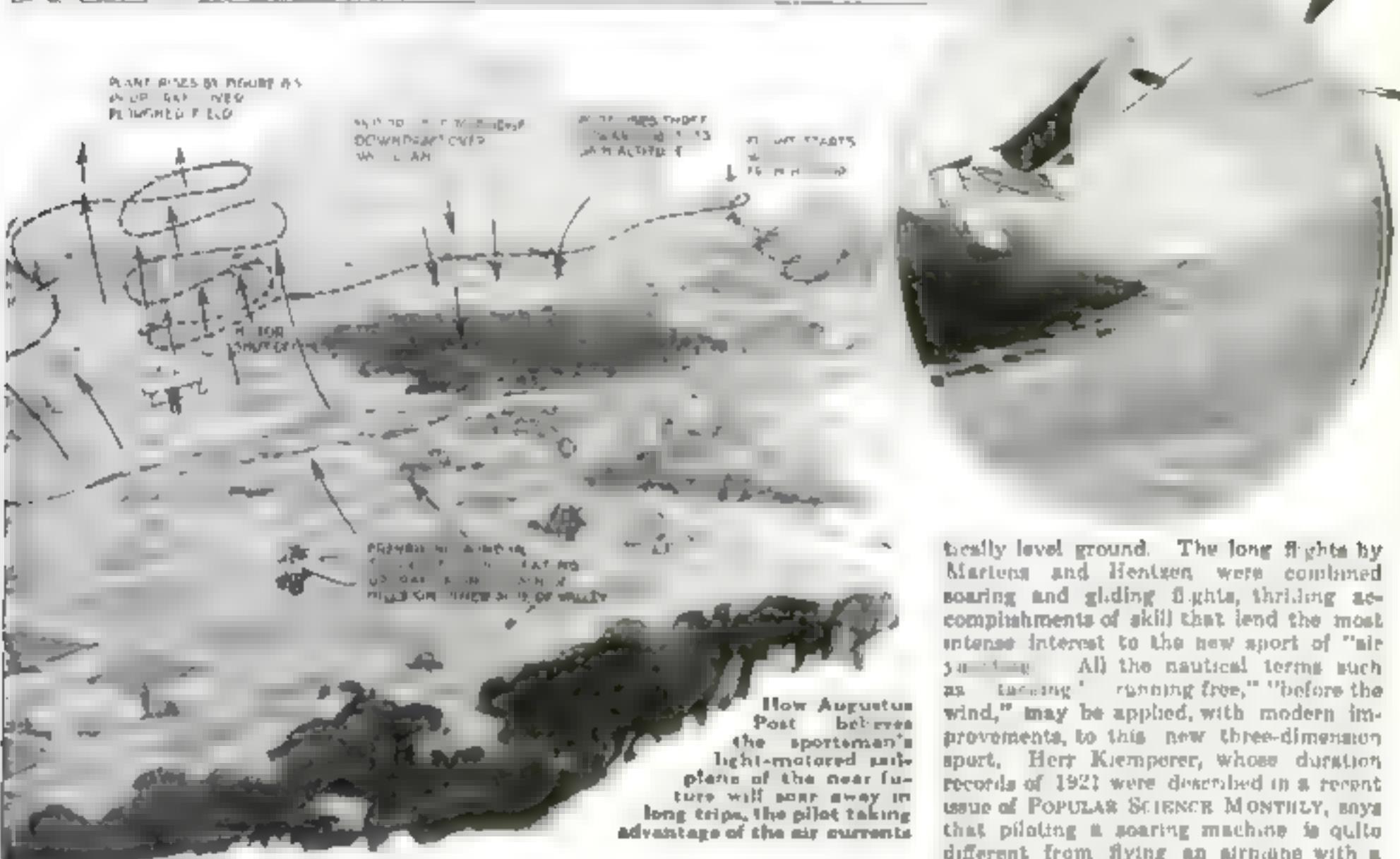
a feature of wing construction adapted from nature's models.

The hop-off of the Vampyr for its record flight is typical of the manner in which a sailplane, as now constructed, takes the air. As the machine takes its place on the slope of the Wasserkuppe, highest hill in the Rhön range, each of three husky fellow students of the pilot holds the end of a rope that is thrown through a hook just beneath the machine's nose. After some jockeying with the wind, the pilot, picking a favorable moment, signals for the start, and the three students run down the hill, facing the wind, hauling the sailplane behind them. With a slight lurch, the wings catch the air;

through Powered Flying. Back to Soaring Again



AS THE culmination of a quarter of a century of soaring experiments and powered flight, comes the popular priced air yacht below, now manufactured in Germany. This sailplane is being marketed, with or without nine horsepower motor at prices ranging from \$190 to \$650.



the ropes are jerked clear of their hook, and the plant scours away, on a level course, to the crest of the next hill where, catching a new current, it rises higher, then descends slightly until another current is encountered.

Assuming that some day—and that day may be soon—you will pilot your own sailplane, how will you guide it? How will you travel and climb in such a craft? What will make it go?

The motor power you will use in "soaring" or "sailing" flight will be derived from using the force of air gusts within the wind and the energy of rising air currents to offset the action of gravity. You will find two kinds of wind suitable for soaring. First, winds that blow upward, due to the slope of the ground—such as the slope of a hill, mountain, ridge, or range of mountains—also rising columns of air over heated areas on the ground—such as plowed fields, deserts and extensive

five manufacturing districts. Second, horizontal winds with strong gusts.

Rising in a vertical wind is not, properly speaking, "soaring"; it is really the same as ordinary gliding flight, except that the wind is blowing upward. True soaring flight—the aim of all the present experiments—uses the energy of a gusty wind, generally horizontal, to soar over prac-

tically level ground. The long flights by Martens and Hentzen were combined soaring and gliding flights, thrilling accompaniments of skill that lend the most intense interest to the new sport of "air sailing." All the nautical terms such as "tacking," "running free," "before the wind," may be applied, with modern improvements, to this new three-dimensional sport. Herr Kiemperer, whose duration records of 1921 were described in a recent issue of POPULAR SCIENCE MONTHLY, says that piloting a soaring machine is quite different from flying an airplane with a motor, but that a good airplane pilot might have the advantage of air experience over the novice.

Certain it is that success in "air yachting" requires complete mastery of the knowledge of air currents and meteorological conditions in order to make instant decisions in difficult situations and to take advantage of the variations of wind speed in the form of gusts representing energy available for soaring. The pilot must so maneuver that there will be a constant wind speed behind his machine, thereby using the energy liberated from the gusts to perform the work necessary for flight. Because we cannot "see" air, such maneuvers are difficult, for we do not know the exact form, periodicity, duration, or relative strength of the gusts.

The best gusts for sowing are those with a long period of increasing speed, followed by one of constant maximum, then gradual decrease and finally a period of minimum strength.

(Continued on page 94)

Augustus Post Knows the Secrets of the Air

THIS article represents the first really authoritative magazine contribution in this country in reference to the amazing record of the German aeroplane fliers, to come from an expert who, both as writer and aeronaut, stands among the nation's leaders. Augustus Post can explain and predict the astonishing possibilities of soaring motorless through the air because he knows the air "inside and out.

Mr Post, one of the founders of the Aero Club of America has himself built and operated gliders. he was associated with the Wright brothers in their early experiments. he organized the first international balloon race in St Louis, in 1907 and he holds America's record for distance of balloon travel in a single flight.

As lecturer, writer and organiser he has been a leader prominent in the development of all forms of aeronautical activity in this country, and his extensive ballooning experience—in the course of which he was compelled to study air currents as few pilots of aeroplanes have had to—has put him in position to explain, as he vividly does in this article, the secrets of the astonishing soaring experiments in Germany.

How Plant Hunters Risk Lives to Find New Foods for Your Table

By E. L. Jones from an exclusive interview in POPULAR SCIENCE MONTHLY
with Henry C. Wallace, Secretary of Agriculture

THIS is the story of the men who risk their lives in the hills of the world's wastes and jungles to find new foods for your table. It is the story of a giant of government, the plant hunter, and his work in the U. S. Department of Agriculture, and his helpers, the plant hunters who are looking for new products and new foods for our country, more than 100,000 acres of new lands, virgin forests, virgin waters, and virgin regions and wastes throughout the great bulk of America. The cost of exploration and expense is high.

A million-dollar year can be spent by these crop explorers.

From the time he first came to America, Dr. David Fairchild, father of Uncle Sam's Seed and Plant Introduction, has been a giant in the field of agriculture. He has made a valuable contribution to the welfare of our country.



An "Ellis Island" for Immigrant Plants

HUNDREDS of food delinquents have passed through that little frontier in the Department of Agriculture. We call it the "Seed and Plant Introduction Station." It is here that seeds and plants from the world over are gathered and catalogued so that we may know them.

Among the latest arrivals there are a number of exotic vegetables, fruits, and nuts. Some of these are new to us, others are old but not well known to us. Among the most interesting are the following: A small bitter gourd, larger than our cucumber, but not so bitter. A large watermelon, very sweet, but not so large as the best. The best of all knowledge of it at the moment, see the review.

We ate much more of a fruit never heard of than ever. Giant radish, a vegetable resembling our squash, radish from the West Indies, a potato-like root crop that grows in sections of the South where potatoes will not grow. Come back giant blackberry, the world's largest edible berry, growing to a length of six inches. Aces berry, like the raspberry in growth, with fruit resembling our blueberry. Andean chestnut, round, sweet, perhaps as big as a peach, the size of an apricot and resembling the chestnut in character and flavor. Balsam pear, a great big seed from German East Africa, six or seven inches in diameter and tasting like our butternut. Soy bean from China and Japan, most delicious, rich in oil with nutty flavor. Indian mango, a fruit with combination apricot and pineapple flavor.

Above: Dr. David Fairchild, father of Uncle Sam's Seed and Plant Introduction, of which he is now director. Giant bamboo forest in California, for which Doctor Fairchild sent from China the first cuttings 25 years ago, proving monuments to his work, while the mango, India's "sacred fruit," now being grown in our own South, is gradually won to popularity as a result of Doctor Fairchild's efforts.

Dr. Frank N. Meyer, a pioneer plant hunter, who for nine adventurous years enriched American gardens with innumerable choice plants and flowers, and finally perished while seeking new foods for us in a remote corner of Asia.

THE PIONEER'S ANNUAL \$1,000,000 CROP FROM A FEW FINDS MADE BY UNCLE SAM'S ADVENTUROUS PLANT HUNTERS	AMERICAN GOURD \$200,000 ANNUAL CROP	INDIAN BLACK \$100,000 ANNUAL CROP	CHINESE KALE \$100,000 ANNUAL CROP	SUBAN GRASS ZIZANIUM, ETC. \$100,000 ANNUAL CROP



Vegetable Ice Cream

From the South American Andes, the cherimoya, or "vegetable ice cream," was introduced into this country by Wilson Popenoe (center), and now flourishes in California. The inner part of the vegetable, a creamy white substance, blends pineapple and banana flavors.

through swampy terrain, where the chances of escaping the jungle fevers are 99 to one against the white man. Their only goal, through all the suffering and privation, is a rare plant which, if introduced into the agricultural life of America, may add, it is hoped, to the farm wealth and food resources of the country.

Despite myriad dangers, the intrepid plant hunters of the United States Department of Agriculture are constantly penetrating the wildernesses of Africa, China, Manchuria, the Philippines, South America, Egypt, and elsewhere, veritably combing these distant regions for samples of native plant treasures that may be introduced to America and tested out on our soil. If the new products are found satisfactory, they are added as permanent items to our crop schedules in those sections of the country where they prosper. The range of climatic, soil, and topographical conditions in the United States is so wide and varied that practically every crop or plant that can be grown anywhere else in the world can be raised successfully in some part of the United States. Some of our agricultural lands that previously were relatively cheap

Five Thousand Miles on Muleback

Wilson Popenoe, one of the most persistent of Uncle Sam's plant hunters, who for the past 10 years has been traveling through tropical America in search of new fruit varieties. In his quest he has ridden at least 5000 miles on muleback, as shown above, usually with only an Indian companion.

and unimportant, have been made valuable as a consequence of the introduction of certain foreign crops that were found to be ideally adapted to the particular soil and climate of the region.

Farmers in the north plains states (North and South Dakota, western Minnesota and Montana) depend largely on the high-yielding durum wheat that was first introduced from Russia (it constitutes 16 per cent of the spring wheat crop). The area devoted to this crop averages 8½ million

Fruit from Guatemala

Introduced by Wilson Popenoe, the Guatemalan avocado or alligator pear, of which fine specimens now being grown in California and Florida are declared to be remarkable delicacies and far superior to the alligator pears that prematurely reached the market a few years ago.

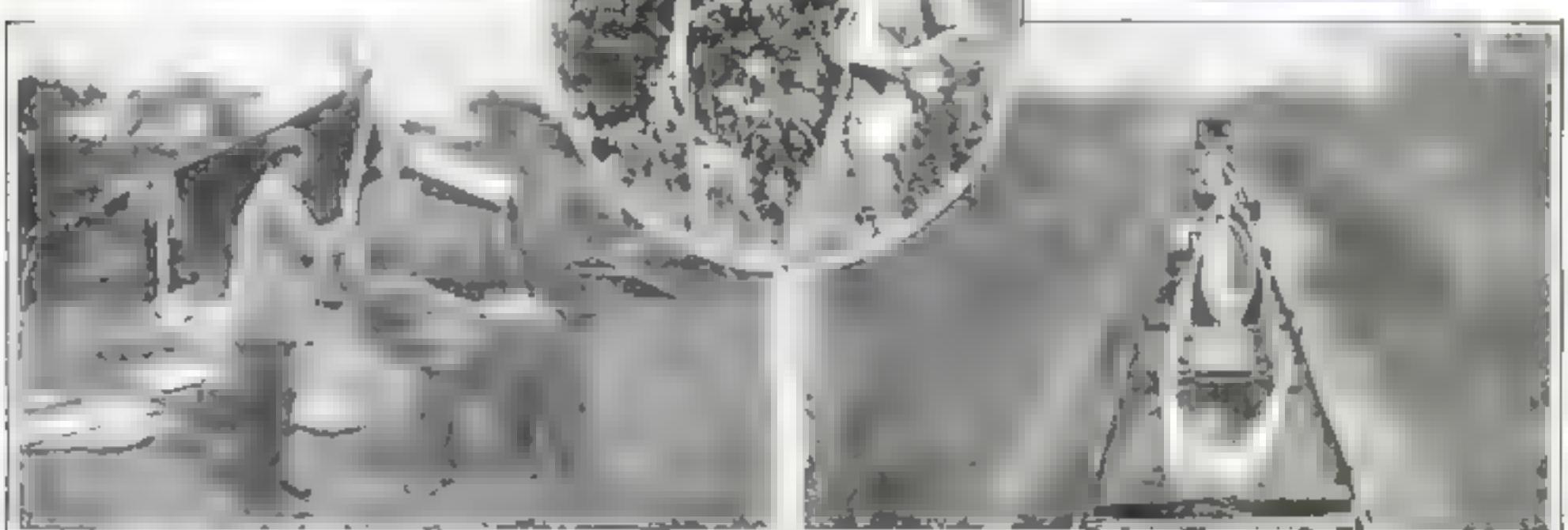
acres. In 1921 it was almost five million. In the past five years, the quantity raised annually has ranged from 26,000,000 to 60,000,000 bushels. The average annual production, at one dollar a bushel,

would amount to \$40,000,000.

California is now able to market in excess of 18,000,000 boxes of navel oranges annually, as a result of the introduction of this fruit from Brazil. Our average Japanese rice crop of over 47,000,000 bushels, in the past three years, is valued at an average of \$16,000,000 a year. The comparatively small sum that the government spent in studying, introducing and establishing this industry was well invested.

Corn would never grow satisfactorily in the southwestern and plains states. The importation of Sudan grass, and of grain sorghums, including kafir, milo and teffetea

drought resistant grain crops—found and introduced by Uncle Sam's plant hunters—now enables farmers in these semi-arid regions to grow about \$105,000,000 worth of these crops annually. Egyptian cotton, introduced by the same agencies, yields annually approximately 17,500,000 pounds of

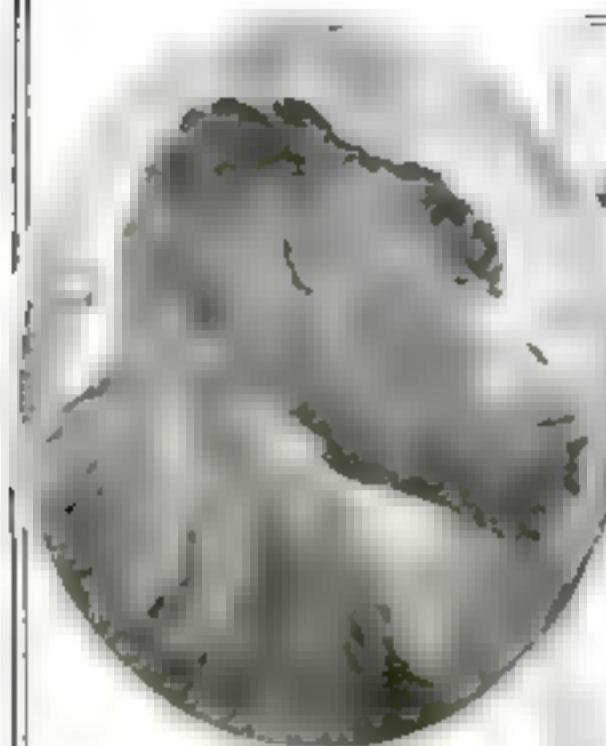


This baby elephant was captured by Plant Hunter H. L. Shantz during his 9000-mile expedition into Africa.

The upper picture shows Dr. H. L. Shantz examining a wild cotton plant in Anglo-Egyptian Sudan, Africa.

How Doctor Shantz and his expedition traveled through Central Congo. Note the dugout canoes carried by rail.

Here Are the Most Wonderful Gorilla "Portraits" Ever Taken!



Profile of an old male gorilla, showing the flat top, the high crest at back of head, the heavy, bulging brow, and the unusually small ears and the tremendously powerful jaw.

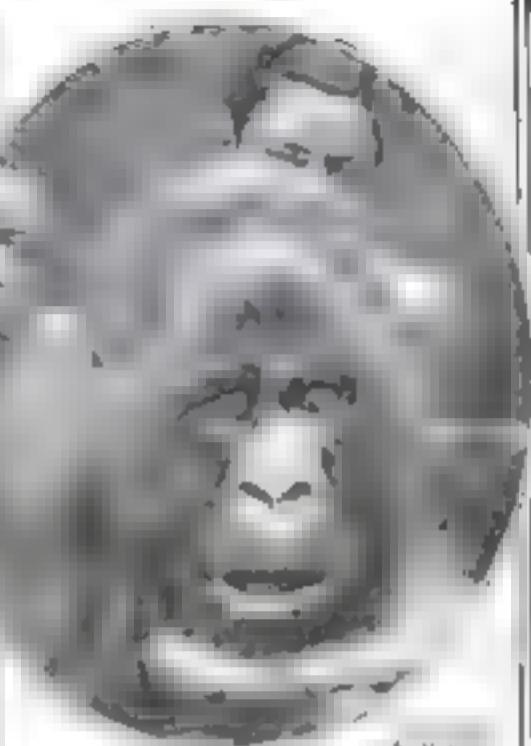
THREE amazing gorilla photographs reproduced here are not only the most remarkable pictures of their kind ever published but are a valuable addition to scientific knowledge of the fierce "manlike" ape—the largest and strongest of all the ape tribe. They were obtained by T. W. Burnes, Fellow of the British Royal Geographic Society, during a recent expedition into the wild gorilla country west of Lake Kivu in the Belgian Congo, Central Africa.

How little has been known of the actual life and habits of the gorilla, although of all anthropoid apes he and the chimpanzee represent the nearest approach to man in bodily form and intelligence; these photographs are of exceptional interest.

The center picture, showing an African native, five feet ten inches tall, standing beside one of the manlike monsters of the Lake Kivu country, gives an idea of the



Compared with this giant gorilla from Lake Kivu, Belgian Congo, the African native, a striking five feet ten inches tall, looks puny. Note the animal's long, powerful arms, short legs and bare breast. He weighs more than 450 pounds.



Ferocious? Yes, but this shaggy head twice the size of a man's encloses a brain that for intellectual capacity is nearest approach to human.

In the photograph at the right note the wide, wrinkled nostrils, and especially the heavy bulging brow ridges that also are marked characteristics of the so-called prehistoric "ape man" skull recently unearthed in Rhodesia, South Africa, and believed by some scientists to be that of a pre-human ancestor. This skull was probably described by C. M. Beaufort in POPULAR SCIENCE MONTHLY. The gorilla's great strength has only recently been noted. Dr. William T. Hornaday, director of the New York Central Park and an authority on wild animals, has written: "The gorilla is the most powerful animal in the world."

Tunneled Stern Gives Super Speed to Twin Screw Racing Boat

BY AN ingenious arrangement of surface propellers inclosed within an air tunnel, George F. Couch, of New York City, has perfected what experts say is the first successful twin-screw racing boat in history—the Rainbow II, a marvel of speed that marks a valuable contribution to the science of speed boat design.

Heretofore the chief drawbacks to twin-screw displacement have been the added resistance of an extra submerged propeller shaft, and the difficulty of making sharp turns.

These difficulties Mr. Couch has overcome by the use of surface propellers—only the lower parts of which are immersed. The propellers are placed in an open well located at a distance from the stern equal to one third the length of the boat. This position insures that steering will not be hampered in turning sharp corners.

To supply the propeller tunnel with circulation of air, an opening in the deck



A speed marvel, the Rainbow II. Diagram shows position of surface propellers in air tunnel leading to the deck.

leads to the propeller well. When the Rainbow II is in full speed, the air rushes down this well, through the propeller, and out under the stern.

Although the over-all length of the boat is 32½ feet, the "wetted surface," which is that part of the hull in contact with the

water at full speed, is only 12 feet. By means of two longitudinal breaks or stops running parallel to the keel, the beam of the boat is only 5½ feet at top speed.

With the two engines developing 650 horsepower, the Rainbow II has attained a speed of 54 miles an hour in practice runs.

How America's Longest Tunnel Will Pierce Rockies

Colorado's Six-Mile Bore through Continental Divide to Throw Vast Wealth Open to Nation



Transcontinental tourists in automobiles and motor trucks will be hauled through the tunnel on flat cars, inflated to the air pressure. The picture above shows the portals of the main, or traffic tunnel and the secondary water tunnel, the press nearly as they were completed.

HOW America's longest tunnel—the proposed six-mile bore through James Peak, Colo.—will pierce the Continental Divide. This diagram shows the main tunnel and one end of the small "pioneer" tunnel, to be used first in construction of the main bore, and then to carry to Denver a fresh water supply from the western slopes of the Divide. Since the eastern or Denver end of the tunnel is 90 feet

higher than the western, gravity pressure for this water must be obtained by means of an intake shaft on the western slope, with the intake at a point higher than the peak of the tunnel. Compressed air lines will also be carried through the pioneer tunnel, to ventilate the main tunnel through ducts connecting both bores at intervals. Electric service lines will pass through the same tunnel

HALF a mile below the snowy summit of James Peak—a 13,283-foot Rocky Mountain barrier in northern Colorado—work will soon start on the longest and, from an engineering standpoint, the most remarkable tunnel in the Western Hemisphere—a six-mile bore through the granite backbone of the Continental Divide, at a point 50 miles west of Denver, Colo., on the line of the Denver & Salt Lake Railroad.

Comparable in magnitude only with the famous 12-mile Simplon tunnel through the Alps, the great mountain-piercing tube, when completed, promises not only an important time-saving advance in transcontinental transportation, but the opening to the world of vast treasures of ore, coal, and timber.

Denver's "Place in the Sun"

Considered merely as a local enterprise, the James Peak tunnel will mark the final chapter in Denver's 60-year struggle for recognition as a transcontinental railroad center. It is expected to result quickly in a 30 per cent increase in the city's population as well as an enormous increase in its prosperity. But from a national standpoint completion of the tunnel—probably within the next 3½ years—will bring tremendous public advantages, of which the following, from the estimates of engineers and geologists, are the most outstanding:

Eight hours of railroad running

time, represented in a distance of 154 miles, between Denver and the Pacific coast, will be saved.

The present shortest traveling distance across the continent will be shortened 73 miles, and four hours will be saved in transcontinental trips.

Maximum grades will be reduced from eight to two per cent.

Rich coalfields, estimated to contain

more than \$5,000,-
000,000 tons—enough
to keep the whole
United States sup-
plied for 100 years—
will be made available
to world markets

There will also be opened more than 2600 square miles of oil shale with an oil producing capacity of 50,000,000,000 barrels, and, as a by-product, 900,000,000 tons of sulphate of ammonia—enough to fertilize every farm in the Mississippi Valley.

More than 10,000,000,000 feet of timber will be made available for use.

Other natural resources that, according to these estimates, will become available, include copper ore, gold, radium ore, gypsum, graphite, lead, manganese, mercury, marble, salt, silver, slate, sulphur, tungsten and zinc.

Tunnel May Pay for Itself

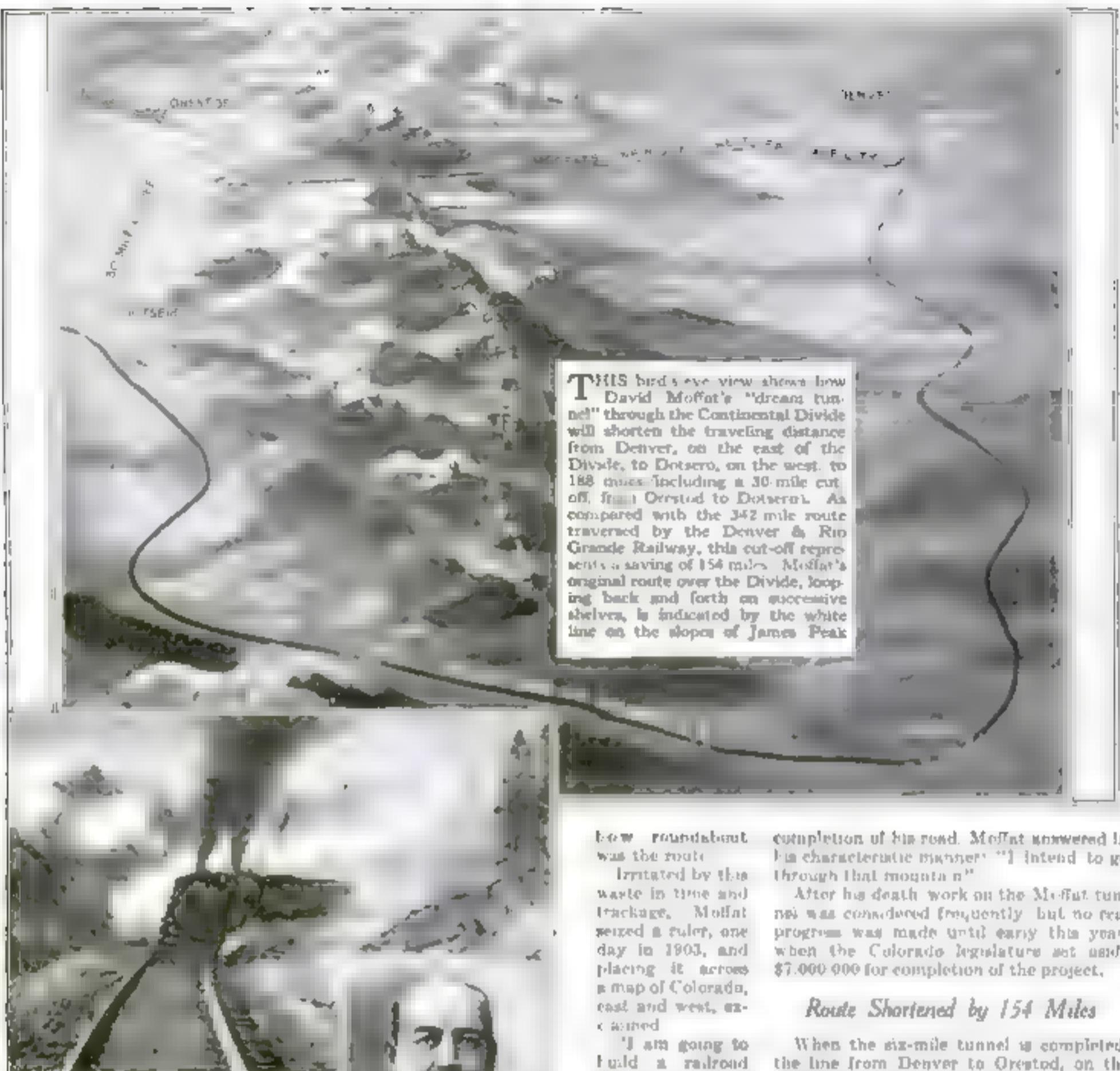
Indeed, the cost of boring may have been met by unearthed treasures long before the first train passes the tunnel's portal.

The passage of that first train will be the climax of a dramatic battle to conquer a grim continental barrier, begun 54 years ago when David H. Moffat, "the grand old man of Denver," then 60 years old, threw his entire fortune and ability into the construction of the Denver & Rio Grande Railroad.

Faced by the unconquerable barrier of the Rockies, which are at their highest opposite Denver—the city had seemed for many years to be hopelessly cut off from any direct route farther west, and was shunned by transcontinental railroads that selected other routes over the Rocky Moun-



Instead of boring the Moffat tunnel only from each end, as is usually done, the engineers plan to construct first a small parallel "pioneer" tunnel, and, cutting through at various points from this to the line of the main tunnel, to dig the latter in both directions from these points, so that perhaps half a dozen sections of the six-mile underground tube may be under construction at once.



THIS bird's-eye view shows how David Moffat's "dream tunnel" through the Continental Divide will shorten the traveling distance from Denver, on the east of the Divide, to Dotsero, on the west, to 168 miles, including a 30-mile cut off, from Orested to Dotsero. As compared with the 342 mile route traversed by the Denver & Rio Grande Railway, this cut-off represents a saving of 154 miles. Moffat's original route over the Divide, looping back and forth on successive shelves, is indicated by the white line on the slopes of James Peak.

David H. Moffat (at right), who gave his fortune and life to building the railroad which, for lack of the tunnel he dreamed of but could not finance, had to climb, as shown above, almost impossible grades over snow choked passes.



tales. It was in 1868, that energetic citizens pledged their money to build the Denver & Rio Grande. This railroad gave Denver its first transcontinental connection, but the circuitous route which it followed proved to be a serious drawback. Dipping southward from Denver, the railroad that was supposed to connect the Colorado capital with the Pacific Coast meandered 160 miles without advancing an inch toward its ocean terminus, while it sought an opening in the Rockies through the Grand Canyon of the Arkansas and the Royal Gorge. The Santa Fe road also had its eyes on this route and the race to the gorge became a stirring contest of engineering skill. The Rio Grande won, and for years was the only railway line to the West from Denver.

The above bird's-eye view of the Continental Divide country in Colorado reveals

how roundabout was the route. Irritated by this waste in time and trackage, Moffat seized a ruler, one day in 1903, and placing it across a map of Colorado, east and west, ex-

claimed

"I am going to build a railroad along the line of that ruler, west from Denver to Salt Lake."

Work started immediately on the "Moffat Line" out of Denver to Salt Lake City, straight as the

crow flies, over the Great Divide. Obstacles were met and conquered, but Moffat's millions dwindled. Determined to raise the money for the completion of his railroad, Moffat went to New York where, burdened with financial worries, he died in 1911.

He lived long enough to see the road completed as far as Steamboat Springs, about 100 miles northwest of Denver. Only one thing had made him deviate from his original straight line project. That one obstacle was James Peak.

The original Moffat road reached the slope of the peak at an elevation of 9190 feet. From there on, in a distance of 24 miles, the track rose to an elevation of 11,700 feet! Trains made their way slowly over this tremendous grade, and then only by looping back and forth on successive shelves. Twisted about this defect in the

completion of his road, Moffat answered in his characteristic manner: "I intend to go through that mognata n."

After his death work on the Moffat tunnel was considered frequently but no real program was made until early this year, when the Colorado legislature set aside \$7,000,000 for completion of the project.

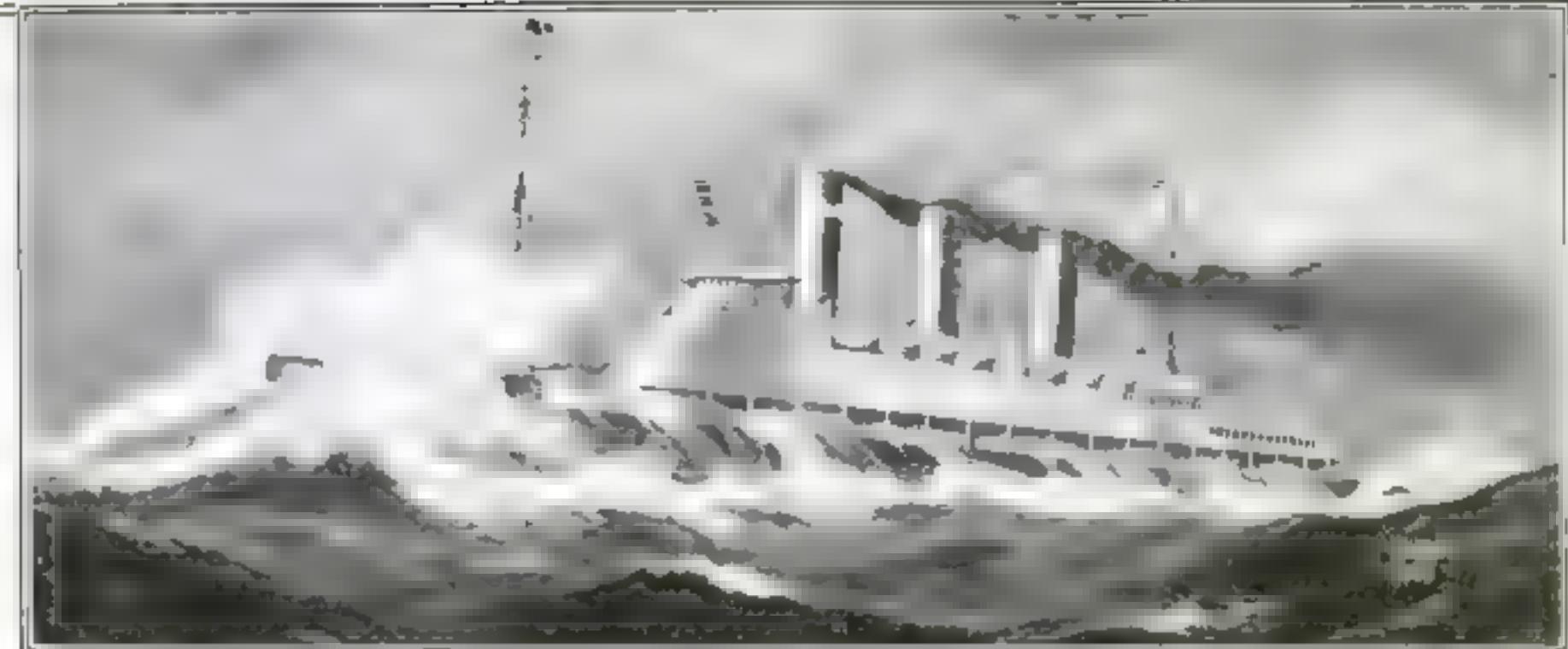
Route Shortened by 154 Miles

When the six-mile tunnel is completed, the line from Denver to Orested, on the western slope of the Divide, will cover a distance of 168 miles. With a 30-mile cut-off from Orested to Dotsero, the total distance by rail from Denver to Dotsero will be 168 miles, as compared with 342 miles over the circuitous Denver & Rio Grande.

The plan of construction calls for two bores—a small preliminary or "pioneer" bore, eight by 10 feet, to be driven first, and the main tunnel, to be 16 feet wide with a clearance of 24 feet. Rock from the main tunnel will be removed through galleries connecting with the pioneer bore.

Work will be started at both portals of each tunnel simultaneously. When the main tunnel is completed, electric locomotives, supplied with power from specially built generating stations, will haul not only trains, but motoring parties in their automobiles and motor trucks, on flat cars, through the great tube.

Eventually the small pioneer tunnel, designed primarily to aid in constructing the main tunnel, will be used for power transmission lines, telephone, telegraph, and light wires; while carrying also compressed air lines to ventilate the traffic tube through transverse ducts connecting the two tunnels.



Proposed McDougall ocean liner.

How the proposed McDougall rectangular ocean liner would plow through heavy seas. With passenger cabins supported

on turrets high above the decks, the unusual vessel would be stabilized, the designer claims, by waves sweeping the deck.

Sees Speed and Comfort in Flat Bottomed Liners *Veteran Designer of "Rectangular" Lake Freighters Predicts Economy for Similar Self-Stabilizing Ocean Vessels*

THIRTY years of success in riding heavy seas on inland lakes and along coastwise cargo routes have so demonstrated the seaworthiness of the flat-bottomed, straight-sided ships designed by Captain Alexander McDougall, of Duluth, Minn., that the veteran mariner now proposes the use of his long famous "rectangular" vessels in transoceanic service to replace the gracefully curved ocean liners with their higher construction cost and smaller cargo capacity.

The feature that has spelled success for the McDougall rectangular ships in years of service is the flat deck placed low on the ship's frame with the deliberate purpose of permitting the crests of waves to wash aboard. When a McDougall ship noses into a combber, it picks up water and holds it for an appreciable time. This prevents the ship from rising at once and so reduces the pitching.

Below, photograph of one of McDougall's rectangular freighters, on the Great Lakes, shipping a sea. Note the flat deck.

Because the outlines of the bottom and deck are practically identical in design, the construction of the ship is greatly simplified. After the shape has been marked out,

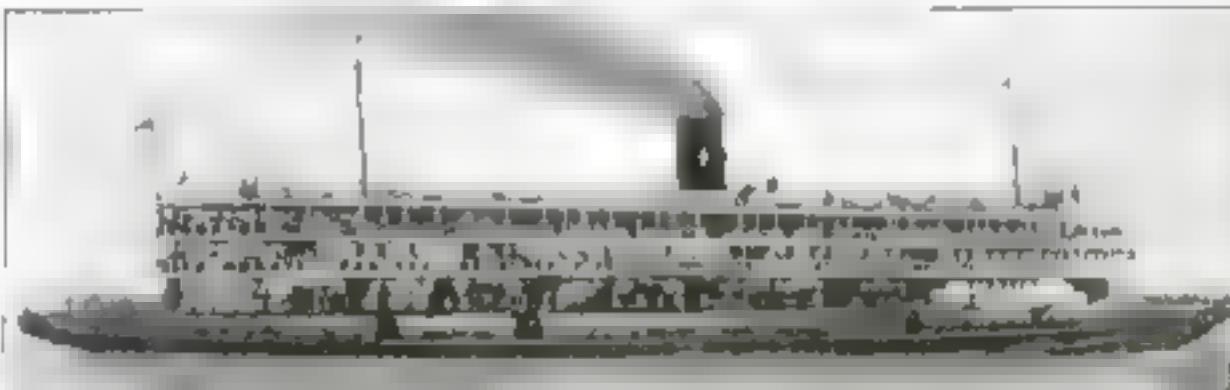
frames are of equal length. After they are riveted in place, deck frames corresponding exactly with the hull frames are attached to the uprights and the vessel is ready for the plates.

Rectangular ships cost less to build and to maintain because their straight sides allow the builder to use standard steel beams. The absence of curved bilges makes forming machinery unnecessary. Compared with an ordinary ship of equal size, the rectangular ship will have a greater cargo capacity, and

will draw less water when fully loaded.

When the idea is applied to passenger ships, the same flat-decked hull is used. The cabins are supported on turrets resting on the flat deck. Waves taken aboard sweep along the flat deck and under the staterooms, but not over them.

Forty-five of the rectangular ships have already been built, most of them plying the Great Lakes.



The "whaleback" Christopher Columbus, famous on Lake Michigan, was built by Captain McDougall with the flat deck and turrets he now proposes for ocean liner

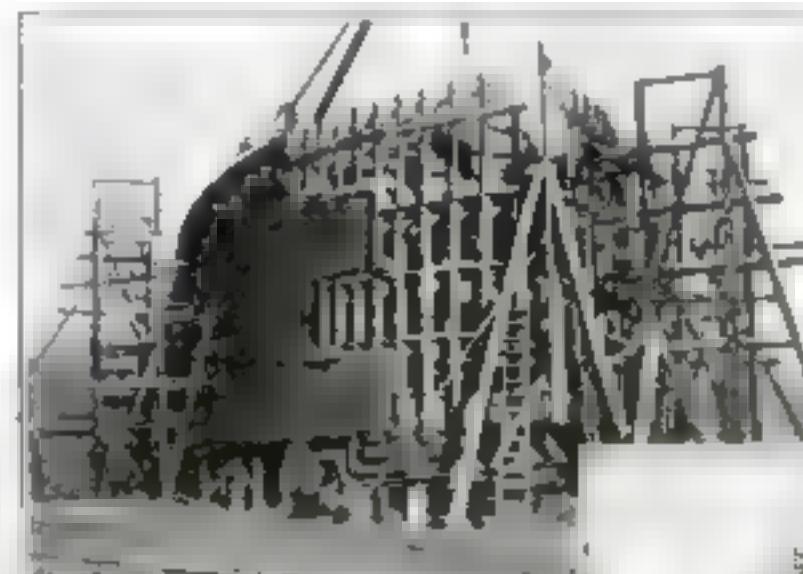
the hull frames are laid in place from stem to stern and the upright frames riveted to them. Because of the flush deck, all side

walls will be flat and the ship will draw less water when fully loaded.

When the idea is applied to passenger ships, the same flat-decked hull is used.

The cabins are supported on turrets resting on the flat deck. Waves taken aboard sweep along the flat deck and under the staterooms, but not over them.

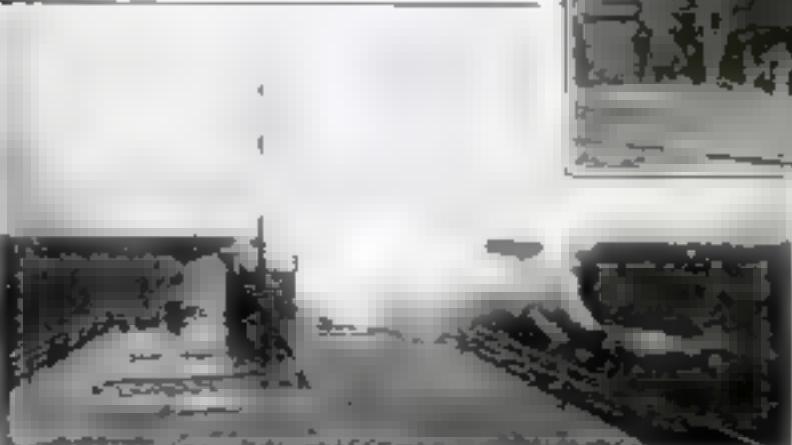
Forty-five of the rectangular ships have already been built, most of them plying the Great Lakes.



Simplicity of design is evident in the above photograph showing a McDougall flat bottomed ship under construction.



A Great Lakes rectangular flat bottomed ship (below), adapted for the canals, provides unusual deck cargo space.



"Battlebag" Is New Sport for Small Yards



The new game of battlebag can be played in a small space either indoors or out by any number of players

BATTLEBAG is a new game devised for either indoor or outdoor sport. The apparatus consists of a horizontal wire stretched between posts, from which a punching bag is suspended by a loop. Knots are placed four feet away from each post to serve as goals.

In playing the game, the bag is sus-

pended from the exact center of the wire with two players directly under it and the teams lined up at each end. At a given signal the two players strike it sharply and the other players advance to the scene. It is then a struggle to see which team first succeeds in sliding the ball by blows across the opposite knot.

Music Case Becomes a Stand when It Is Unfolded

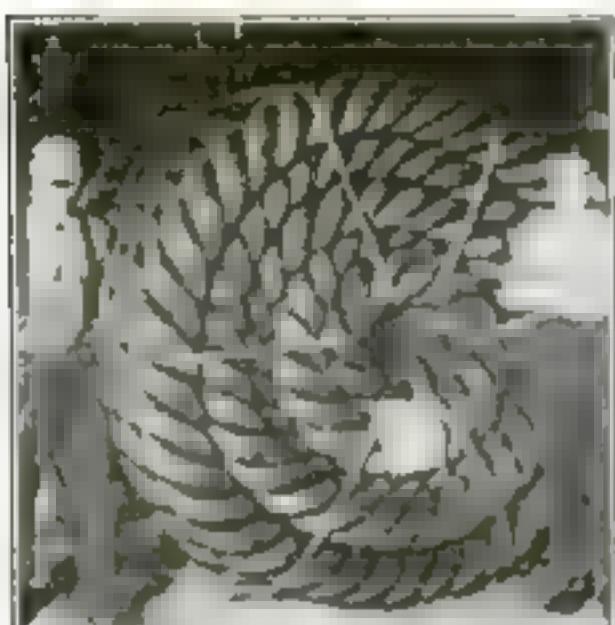
A MUSIC case that may be adjusted for use as a music stand has been invented by Edward L. O'Donnell, of St. Louis, Mo.

When closed, the device resembles a suitcase; but when opened for use, four metal legs drop down and support the



case, one side of which, opening outward, reveals two compartments for the sheets of music.

Within the top compartment are lazy tongs that are extended to provide a support for the music rack. When the music support is depressed, it forms a side wall of the case, which, when folded, is neat enough to be carried anywhere.



This coir hawser is said to be the largest ever made

Largest Tow-Rope Is Spun from Cocoanut Fibers

A COIR hawser 24 inches in circumference, produced recently as a tow-rope for a powerful seagoing tug, is believed to be the largest rope ever spun. It is by no means the strongest ever made, however, since coir-spun fibers of the cocoanut is only about one quarter as strong, pound for pound, as rope of manila fibers, which are obtained from the leaves of the wild banana tree.

Coir is used to advantage because of its astonishingly light weight. It will float on the surface of the water, and therefore is much easier to handle in passing lines from one boat to another.

Many hawsers of this weight are needed to withstand the drag of even a medium size liner.



Boys Rob Tires of Air to Inflate Footballs

BOYS in New York have discovered that the easiest way to blow up a football is to "borrow" a little air from an auto tire—usually the spare at the rear of some unoccupied car.

By slipping the rubber tube of the blower over the top of the valve, the football is inflated instantly, and without undue expenditure of effort.

However, the boys sometimes discover too late that the tire pressure is more than the ball can withstand and an explosion is the reward for their ingenuity.

Ceilings Reached with Telescoping Elevator



The workman climbs to the platform by the cleats on the uprights

FOR interiors where laborers must work at varying heights above the floor a new telescoping elevator has been perfected. It is manipulated by a hand crank at the base. The workman can also use the ladders at the side. For stability, two outriggers with friction cups are swung from the base.

New Detachable Reel Holds Hose without Kinking

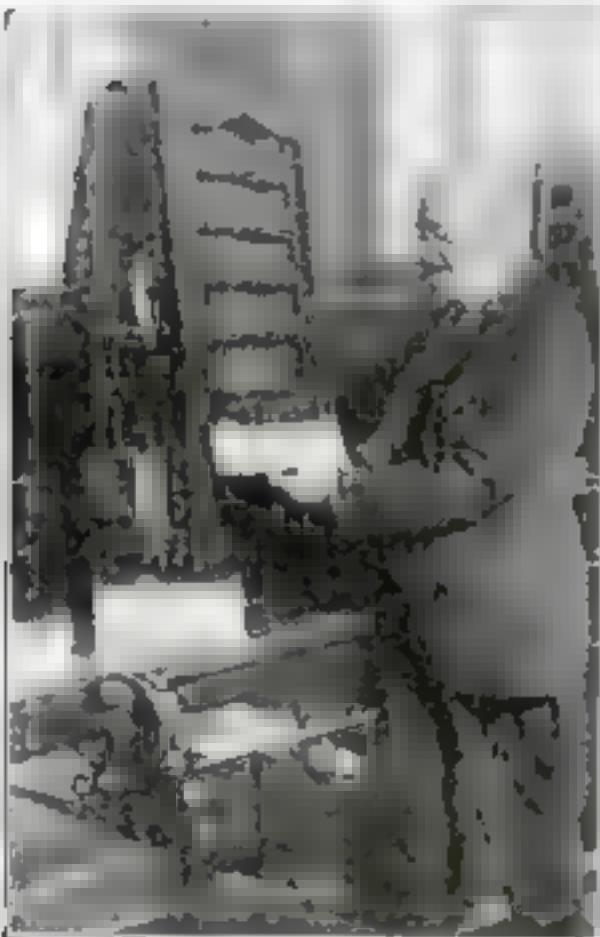


ANY part of the hose or all of it may be unwound from a recently invented detachable hose-reel without becoming looped and kinked and again wound on the reel when no longer needed. The reel is attached to the faucet, around which it revolves freely.

The hose is fitted by a screw joint into a hollow spoke of the reel. This spoke communicates with the axle, which is also hollow and fits into a special faucet that is permanently placed at the end of the service pipe.

Hose and reel never become separated and after the hose is wound on the reel, the latter, together with the hose wound on it, may be put out of the way.

Perforated Cards Despatch City Fire Fighters



The perforated card and automatic despatching machine at "Central"

THIRTY THREE seconds after an alarm is turned in, the fire fighting apparatus of New York City is on its way to the fire. In that short time with the aid of perforated cards the alarm is verified, recorded at the central office, and relayed to

Siren Played by Sliding Drive Belt

THE siren of the siren has been musicalized by a unique invention. Dr. A. R. Naber of Holland, has given him "the magic flute."

In the ordinary siren the pitch of musical notes is determined by the rate of the impulses of compressed air passing through the openings in the

a rotating disk. But in the improved instrument the speed of this disk is arranged to be varied at will by an ingenious driving spindle, producing in the hands of an experienced artist all the tones and semitones of the flute.

The magic



A full range of tones is obtained by sliding the string belt up and down the tapering shaft. The instrument is being tuned.

The outfit consists of a small electric motor that drives the spindle of the magic flute by a flexible cord. While operating the magic flute, the cord connecting the spindle and motor is held between the fingers and altered in position as the score demands.

Every Step Adds a Mile to the View



A fir tree forms the support for this 105-foot fire tower

Photographer Snaps Car in Mid-Crash

FAST work with a camera enabled a photographer to snap the remarkable action picture shown below before the captioned car had ceased rolling. The camera had previously been focused on the turn in the road and the photographer, with unusual presence of mind, followed the skidding car with his lens and snapped the picture.



The pilot was still rolling when the photographer tripped the shutter

AN ADDED mile of sight for every step is claimed for "the Sisters' Lookout," a forest fire station in the Deschutes National Forest, Ore. A frame of rough timber nailed to a fir tree forms a 105-foot ladder to the observation platform.

Speed Increased with Dummy Typewriter

A NEW type-writing machine, invented by Walter A. Butler and A. J. Cooper of New York, increases students' speed by arranging the keyboard in

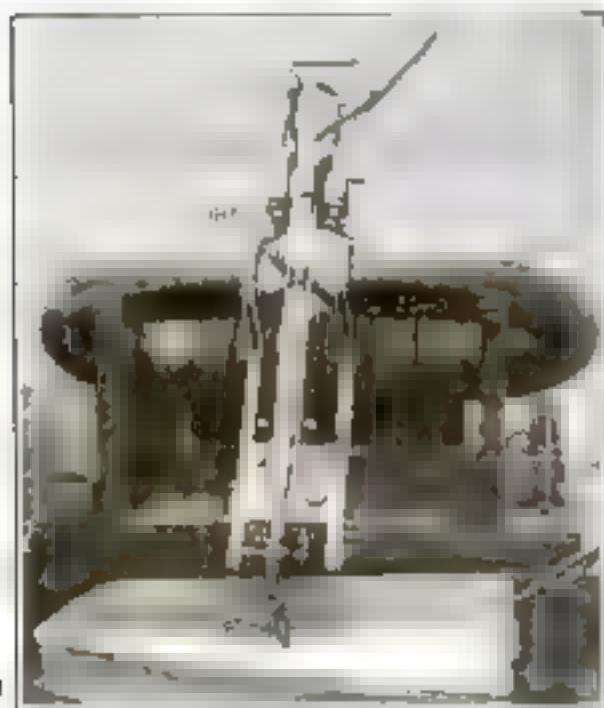


standard, but the keys are blank. Back of the keys are four tiers of letters. Above each symbol is a white disk con-

necting with the dummy keyboard. As a key is depressed, the disk appears.

Thus, in making the word "the," the student receives the impression of three disks composing an acute triangle with the base uppermost. The student's brain retains the "shape" of the word.

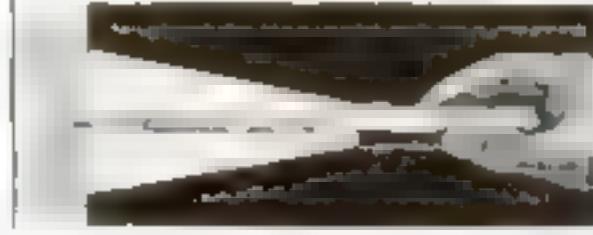
Powerful Electromagnets Now Assay Iron Ore



POWERFUL electromagnets are now used to analyze iron ore when it is desired to find out the percentage of magnetic iron in concentrate. This is usually the case with the magnetic iron ore deposits in Minnesota. The novel electrical apparatus now employed was originally designed and built at the University of Minnesota.

In operation, 10 grams of pulverized sample ore are placed in a glass tube, through which water flows under slight pressure. The tube is placed between the poles of an electromagnet. The current is turned on, and a powerful magnetic field is thrown across the center of the tube from the pointed extremities of the magnet. At the same time the glass tube is rocked slowly by a small electric motor.

The tube pivots on the pole pieces, with the result that all the magnetic ore is held in the center of the tube by the magnet, while the balance collects in the ends. When the washing and concentrating process is complete, it is easy to weigh and compute the percentage of magnetic iron ore in the sample.



Flashlight Illuminates Shadowed Work

HAND tools that supply their own illumination to facilitate the work being done have been brought out by a Mid-Western firm.

The complete toolkit is made up of the handle containing the battery and light source, three wrenches, and one screwdriver. The tools are of drop forged steel.

Air-Hammer Breaks Ton of Pig Iron a Minute

A PNEUMATIC hammer is used for breaking up pig iron in an Alabama blast furnace. When molten iron from blast furnaces is allowed to cool in the pig or cast condition, the various pigs have to be broken up into single sections.

The equipment consists of an air hammer with a piston and striker of unusual size, and with valves and ports so arranged that a blow may be struck of sufficient force to break a pig into halves and sever it from the sow at the one stroke.



An air hammer working at 16 strokes a minute breaks up a ton of pig iron in the same time.

It is used also for breaking up the sows. The cylinder is eight inches in diameter and the stroke 14 inches.

The hammer is suspended flexibly from an electric travelling crane. The bed of pigs is placed on a heavy cast-iron frame, which in turn is mounted on a platform above open-top railroad cars. When the pigs are broken, they fall through the openings in the frame directly into the cars. The hammer is operated by a hand-lever valve at a speed of about 16 strokes a minute.

Auto Carries Record Load for Yeggmen

FINDING conditions in an office building of Los Angeles, Calif., unfavorable to safe-cracking, some robbers walked the streets until they found an automobile. Then driving it to the office building they parked it in front and proceeded to run the safe of an insurance company

from the eleventh floor to the elevator and then down to the ground. The 1100-pound safe was hoisted into the tonneau of the light passenger car and carted several miles before the rear springs finally gave way. Out in the open coun-



Although subjected to a terrific strain, this automobile carried the robbers and a half-ton safe many miles

try the robbers looted the safe of its treasure, and made a baffling getaway.

It is surprising that springs designed to withstand only a few hundred pounds should have held up for miles under such a weight.

Pile Driver Hustles Pipe into the Ground



The dropping weight drives in the pipe.

an eyebolt takes a rope that runs through a sheave. When the weight is released, the impact drives the pipe from six to 12 inches into the ground.

Extracted Nails Are Almost "As Good as New"

BY EQUIPPING a hammer with an adjustable fulcrum that may be extended to any length within the limits ordinarily required in carpentry, J. A. Barton, of Salem, Ore., has invented a device that permits a workman to withdraw nails of any size without bending them.

The extension fulcrum consists of a rod with its lower end enlarged to provide a support. The position of the fulcrum can be readily changed.



By adjusting the fulcrum on the hammer, nails are removed without bending.

IN LOUISVILLE, Ky., the electric power and light company uses a portable pile driver for driving short lengths of pipe. It is said the device cuts the working time from two hours to 10 or 15 minutes.

Before this pile driver was perfected, ground pipes were driven by a sledge in the hands of a man, supported by climbers on the pole.

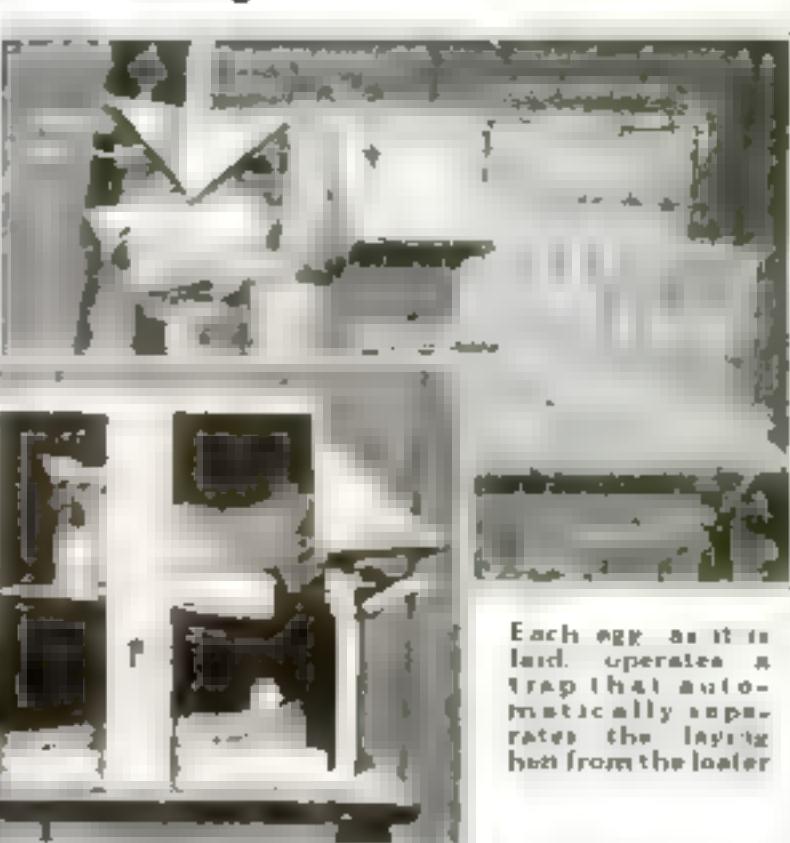
The portable driver consists of an old piece of line shaft, about three inches in diameter and 18 inches in length, attached to a guide rod eight inches long, which enters a one-inch pipe without rubbing. At the other end

an eyebolt takes a rope that runs through a sheave. When the weight is released, the impact drives the pipe from six to 12 inches into the ground.

Trap Nests Betray Loafer Hens

TRAP nests that are laid without supervision have been put to good use at three broths in the San Joaquin valley, Calif., to catch laying hens who lay eggs for loafers.

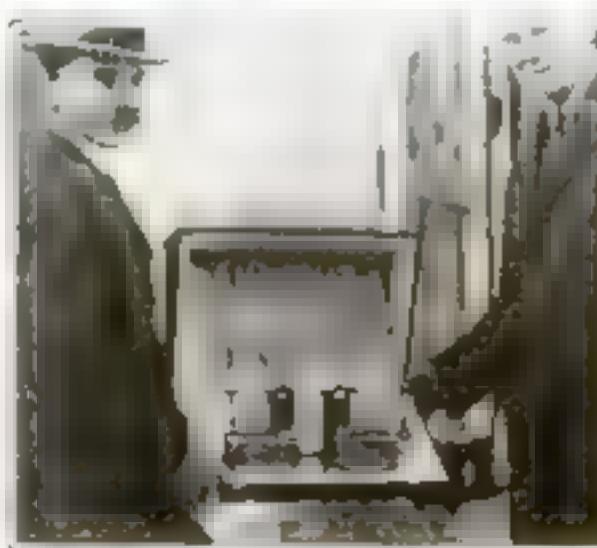
The nest box is a wooden box with an upper compartment and a lower compartment and a four-door. The hen desiring to lay enters from the back yard and goes through one door into the upper compartment. As



Each egg, as it is laid, operates a trap that automatically separates the laying hen from the loafer.

The trap nest is set each morning. At night, hens that have laid eggs are in one yard, while non-layers are in another.

she squats on the nest, the door behind her is closed. If she lays an egg, the egg rolls down an incline into the lower compartment, where it operates a catch that opens a door in the front of the upper compartment. Through this door she steps down into a special yard. If she does not lay, she must leave through a side door. So the laying hens are in the special yard, while the non-layers remain in the back yard.



Inkstand Is Replica of Historic Gates

AND INKSTAND that is a miniature replica of the historic city gates of St. Augustine, Fla., is one of the latest gifts presented to President Harding. The original gates were built by the military governors during the Spanish occupation in the eighteenth century, and St. Augustine is proud of them, since they afford one more proof that she is the oldest city in the United States.

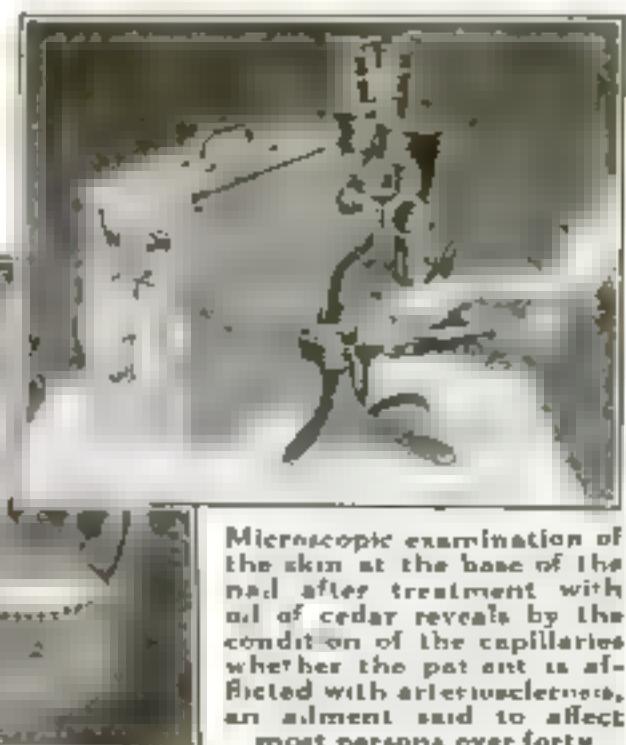
The inkstand is of silver, finished to imitate the age darkened adobe, or clay, of the gates themselves. This effect was obtained by a multitude of fine lines and a dark oxidized finish.

For the purpose of locating unknown lakes that may be the source of valuable water power, the Forest Service will soon take aerial photographs of all the national forest areas of Alaska.

Artery Trouble Detected at Base of Fingernails

HARDENING of the arteries can now be detected in its early stages by examining the skin at the base of the fingernail under a high-power microscope. Doctor Lombard, of the Mayo Clinic, Rochester, Minn., a prominent physiologist, recently discovered that when a drop of cedarwood oil is placed upon the skin and a small but intense electric light held just above it, the minute capillaries that form the smallest subdivision of the blood vessels, become visible under the stereoscopic type of microscope.

At the base of the fingernail the capillaries run parallel to the surface of the skin, and their course can be traced by means of the blood streams flowing through them.



Microscopic examination of the skin at the base of the nail after treatment with oil of cedar reveals by the condition of the capillaries whether the patient is afflicted with arteriosclerosis, an ailment said to affect most persons over forty.

Enormous Steam Heated Spout Speeds Asphalt Handling

BLACK paraffin or asphalt is being about 80 per cent of the oil from which it is obtained. In fractional distillation of certain oils of California, finds a number of uses in the manufacture of varnishes, paints and in the preparation of roofing and road surfacing compounds, but the low price obtained for it calls for a bit of ingenuity on the part of the distillery to cut the cost of handling and shipping to a minimum.

When cold, asphalt is hard as glass, at moderate temperatures it becomes plastic, and above 160° F. it is more or less liquid and can be run through pipes. For transportation it is run into barrels or thin metal drums designed so that the container can be stripped off without difficulty, leaving the asphalt in a solid mass of the same shape as its container.

In one California distillery the asphalt is readily handled by a central supply system with a discharge pipe or spout that swivels to any

One workman guiding the nose of the swiveling filling pipe fed from the storage tank shown at the right can fill hundreds of steel drums over the wide expanse of the paving platform.



Creates Job by Using His Bicycle as Workshop

FINDING himself out of work and with meager assets, consisting mainly of a bicycle, a grindstone, and a few odds and ends, J. E. Anderson, a woodworker of Los Angeles, Calif., solved the problem of making an honest living by transforming his bicycle into a grinding machine.

He mounted the grinding wheel on the frame of the bicycle, so that its axle could be connected with the rear sprocket by a chain. A tripod, connected with a cord so that it could be lowered to the ground formed a firm support for the bicycle when it was lifted off the ground and utilized as a grinder.



He escaped unemployment by rigging his bicycle as a sawmill grinder



Camera Support Is an Aid in Photographing Planes

FOR studying the action of airplanes in flight, Anthony H. G. Fokker, the noted designer and builder of aircraft, uses a motion picture camera and a unique method of support.

When he found that it is practically impossible to photograph an airplane in flight with a motion picture camera resting on a tripod, because of the difficulty of adjusting the camera to the constantly changing angle of the object, he invented a supporting device that fits over the photographer's shoulders. With this suspension the cameraman can tilt the lens instantly to any angle and follow the movements of the plane through the finder.

The illustration shows the famous aircraft builder sighting at a flying airplane while turning the crank of the camera supported by his device.

part of the filling platform. The hot liquid asphalt is pumped into a tank on the roof of the filling station and is kept in liquid condition by steam heating coils. From the bottom of the tank the asphalt flows through a steam-jacketed pipe of large diameter to the filling department below.

The Swivel Pipe

The filling pipe has two sections connected by swivel joints with a similar swivel joint connecting with the outlet of the storage tank. Lattice braces permit the sections to be moved in an extensive horizontal plane.

With the aid of this swiveled pipe one workman can fill 800 barrels or steel drums in an eight-hour day.

Some Secrets of Successful Dog Photography

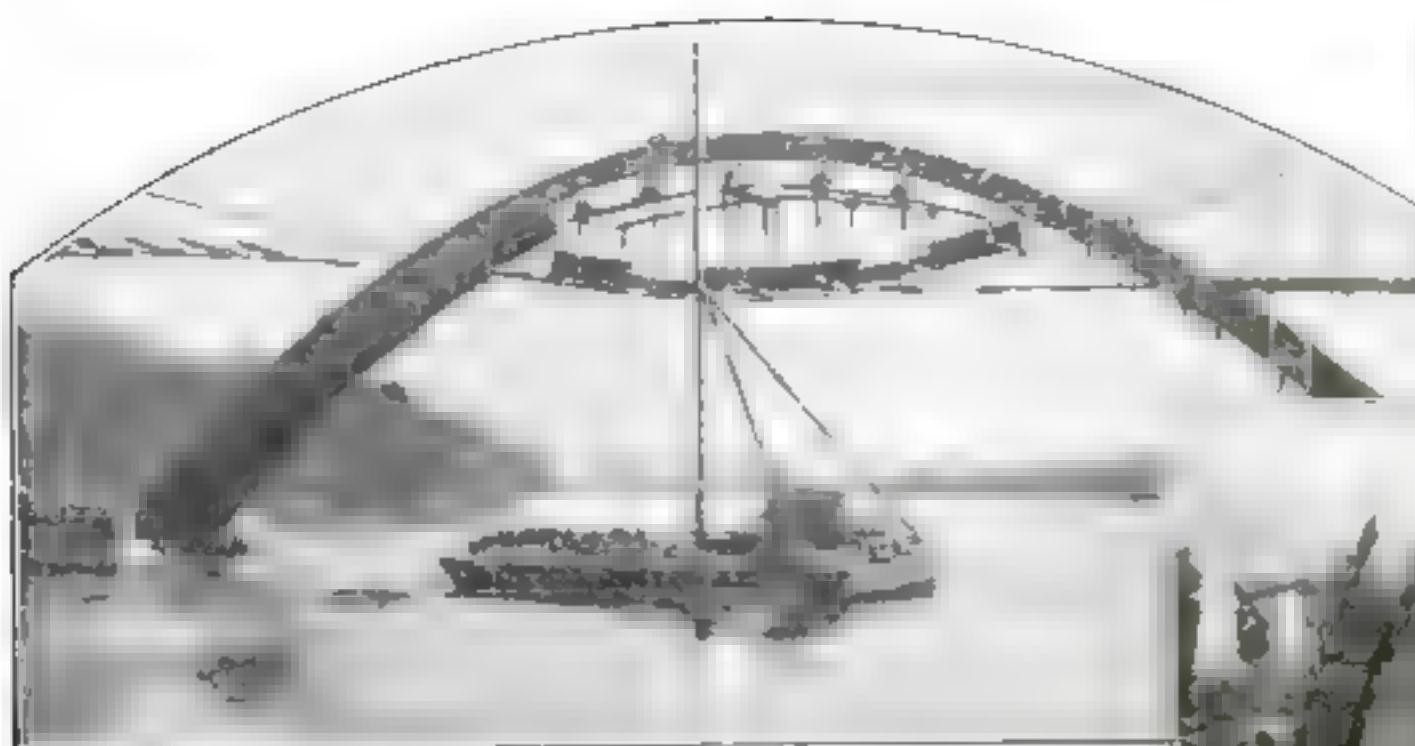
RAW meat placed on the top of the camera is one secret of successful dog pictures. The dog must be persuaded to "watch the birdie" in various ways—by fixing his attention on some person, or on something moving at a distance, for unless the dog's attention is diverted, it will be apprehensive of the lens, and flinch when it hears the shutter click.

To photograph a dog sitting up and holding its fore paws together, which is the most difficult pose of all, the best device is to place a bit of meat between the toes of one fore foot and order the dog to sit up. A well trained animal will obey, but will be so afraid of dropping the meat before it can be eaten that he will hold it carefully and for a time become entirely unconscious of the camera.



Meat between his paws makes him a good sitter

Old Bridge, Doomed, Helps to Build Successor



At left one side of span has been completed by supporting the top sections on timbers held by the old suspension cables

The method of tying back the side sections by means of cables lifted over the old towers is shown below



ALTHOUGH it was unsafe for traffic, the 33-year-old suspension structure over the Willamette River at Oregon City, Ore., proved to be indispensable to the engineers during the erection of the new 350-foot steel arch.

When the bridge builders were prevented from constructing the usual false work, by the great depth of the river at the bridge site and the intensity of water traffic, a scheme was devised so that when a section of the new arch had been swung into position, a cable was carried from it to the top

of the tower and down to an anchor on the far side.

This procedure worked well with the side members, but the last six sections could not be supported in this manner. The engineers finally decided to use the old cable suspension as the support, although it was realized that the weight would approach the dead load limit of the ancient cables. But by working carefully and stripping away all nonessentials, the sections were lifted in

place and supported in location with bridge timbers used as blocking.

As soon as the six top sections were riveted, the old bridge was torn down.

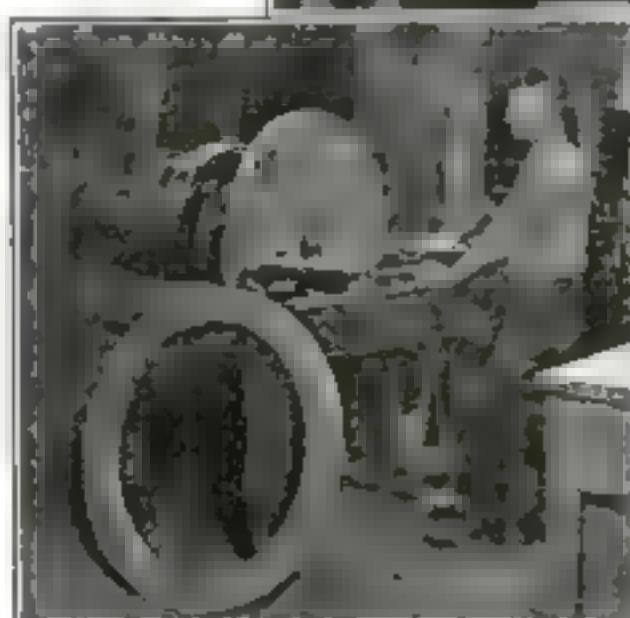
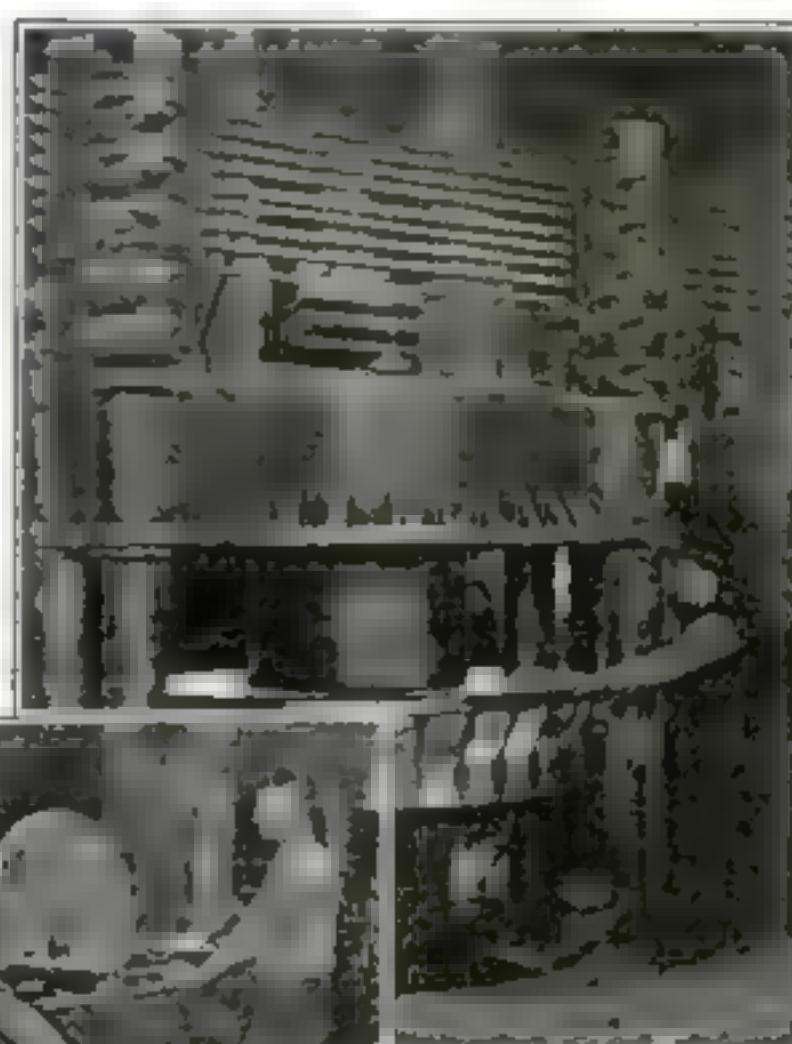
Hydraulic Press Makes Pulleys from Thin Paper Disks

PULLEYS made of thin sections of paper disks, reinforced in their centers by a small metal, steel or cast iron, are manufactured by an interesting use of pressure and high pressure.

First, thin paper disks of a slightly larger diameter than the finished pulley are glued together under high pressure until sections one inch thick are obtained. After a thorough drying, the sections are placed in a lathe and cut to the correct inside and outside diameters. Holes are then drilled at frequent intervals around the edge through which dowels are passed to hold the assembled sections in position.

As many sections are placed over the dowels as are required to make up the desired width and the mass is compressed in a powerful hydraulic press. The pulley is completed by inserting an iron hub in the center of the compact paper cylinder thus formed and trimming down the bearing surface to exact size.

Because of the fibrous texture of the end grain and the fact that this bearing surface is always being re-



After the thin paper disks are assembled they are placed in a powerful hydraulic press and tightly compressed. The machine at the left trims the pulley to correct diameters

newed as friction wears it away, paper pulleys are said to grip the belt better than metal pulleys, making it possible to allow plenty of slack in the belt.

Brake Lining Is Tested on Subway Escalator

BRAKE linings that are compressed under a pressure of 1000 tons and woven and doped by a new process of manufacturing friction fabrics, have demonstrated phenomenal wear-resisting qualities in recent tests. A sample of the new product was recently placed at the foot of an escalator in a subway where 26,000,000 people walked across it. At the conclusion of this severe test, signs of wear were inappreciable.

The "dope," or compound, used to bind together the fibers of the fabric is largely responsible for the wearing qualities. These qualities are enhanced by placing brake lining material in a die press and shaping it to the finished form under a pressure that compacts the fibers and forces the material

to a dense mass two thirds its original thickness.

The fabric is woven by a new system called "progressive weaving," in which the binder threads are placed some distance apart. This means that the top layer can be worn from a brake without reducing the holding qualities of the remaining material.

Did Germs from Other Worlds Bring Life to Earth?

Amazing New Theories about Living Conditions on Mars and Venus

THIS article concerns a question that has long been a subject of interest over the ages. It is the question of whether life originated on our planet or if it came from other worlds. Far less interesting but equally fascinating, is the question of life after it set up housekeeping on earth. The actual known history of evolution—the present condition of the infinite romantic history—on our planet will be presented in the first part of this article, for it is a question of the past. The second part will be devoted to the living conditions on the two worlds of Mars and Venus.

By Scriven Bolton

Fellow of the Royal Astronomical Society

DID the earliest forms of life come from the stars—the tiny parent organisms from which we, and all earthly animals and plants have sprung—reach earth from some other planet? Or millions of miles away in outer space?

Even to-day, are we being showered from breeding places on other worlds with minute bacteria that spread deadly plague among us?

Instead of being a wild speculation, the far reaches of the universe are filled with clouds of tiny "flying seeds" that travel about from planet to planet, borne by the rays of Sun and stars?

Interest in these questions—which are part of a fascinating theory made famous by the great Swedish physicist and Nobel Prize winner, Svante August Arrhenius—has been revived by a current discussion among noted scientists as to actual "life contact" on other planets. Venus and Mars, our two nearest planetary neighbors, the former between us and the Sun, the latter with an orbit just outside our own.

In the last published annual report of the



Typical Landscapes on Venus and Mars

ABOVE is a typical landscape on the planet Venus, as typified by the artist's conception. The sky is dark, it is always cloudy as it is near the Sun. Because its atmosphere has been supposed to be dripping with dense fog and rain, it follows that the famous Arrhenius theory believes that the outer planet of Venus may be a universal breeding place for outer space life, for plants and for disease bacteria viruses. The supposed atmospheric conditions would create an all out continuous exhibition of beautiful solar halos, as shown in the illustration.

The landscape of Mars, as typified at the left, is now supposed to be exactly the reverse. Ocean basins, such as the "sea" known as Syrtis Major, depicted in the imaginary illustration, are declared to be frigid swamps, while the continents are believed to be covered with dry frozen sand, in which life is utterly impossible.

Venus, on the contrary, may have a " soggy," cloudy atmosphere, ideal for the breeding of lower forms of life.

These recent assertions that Mars has an utterly frigid and airless climate have been promptly questioned by Prof. William H. Pickering, of the Harvard Observatory in Jamaica, W. I., world famous student of the Martian canals. While it is now widely

accepted by astronomers that the so-called "canals" of Mars are not artificial streams of water, Professor Pickering declares they may well be bands of vegetation. He adds, further, that the spreading ice caps seen about the poles of the great red planet are, in fact, frozen water, and not the deposits of frozen carbonic acid gas that other astronomers consider them to be. Professor





How Sunlight Might Carry Life from Venus to Earth

WHEN the planet Venus passes between Sun and Earth according to Professor Athelma, rays of sunlight passing through Venusian atmosphere might cast into space countless particles charged with disease bacteria spores and animal and plant

seeds. Some of these particles might ultimately reach Earth.

The nature of the last showing relative positions of Sun and planets supports Professor Athelma's theory that sunlight corpuscles may be distributed all throughout our solar system.

Pickering brings forward some technical evidence to show that there is water vapor enough on Mars to permit of some sort of vegetation, or plants, existing there.

While these two opposing theories

about conditions of both Mars and Venus are still being argued by astronomers of the world, it is to be noted that Venus is the third nearest to Earth and very hot at its size may have an atmosphere.



Where a number of scattered broadcasting stations are within range, the "T-type" aerial at left is best. If only one good station is within range, the most efficient aerial is the "inverted-L type" at right, with lead-in coming from the end pointed toward and nearest to the broadcasting station. Above, three steps in soldering ground to water pipe.

Jack Binns' Ten Commandments for the Radio Fan

First Series: How to Get Better Results with Your Crystal Detector Outfit

By Jack Binns

A FAMOUS radio engineer of my acquaintance quite recently constructed one of E. H. Armstrong's super-regenerative circuits, and undertook a short series of experiments with it. At the conclusion, he summed up his opinion of the new system in these words: "It's no blankety-blank good!"

Now the fact is, of course, that the Armstrong super-regenerative circuit is not only good, but epoch-making. On the other hand, if a thoroughly experienced and competent engineer, who knows radio from A to Z, is unable to get satisfactory results with it, and gives up the attempt after a brief trial, just think how difficult success with it will be for the novice!

Noices Must Be Patient

In other words, at the present stage the super-regenerative receiver is not a circuit for the inexperienced to attempt to build. Many POPULAR SCIENCE MONTHLY readers have asked for help in constructing a set of this type. My best advice to all of them, except the most capable old-time amateurs, is to continue to make the most of present standard apparatus. There is no telling how long it will be before the super-regenerative circuit is refined by the engineers, standardized in commercial sets, and put out in such shape that the novice can easily operate it.

To make the most of the present highly efficient types of radio apparatus, certain fundamental rules and methods ought to be followed that can be most clearly presented in the form of "Ten Commandments for Radio Users." This month, I am presenting Ten Commandments for the crystal de-



JACK BINNS, America's most popular writer on radio, who writes here-with the first of his series of "Ten Commandments for the Radio Fan." Your successful operation of various types of receiving sets, and your enjoyment from radio broadcasts this winter will be enhanced if you profit by the advice Binns offers in this unique series. Next month he will give his Ten Commandments for using the single circuit vacuum tube set and in the January issue a third series of Commandments for operating the feed back circuit.

tector set, to be followed next month by Ten Commandments for the single circuit set, and thereafter by Ten Commandments for operating the feed-back circuit. No matter what type you are using, the following points about the crystal are fundamentally important to you.

The function of a crystal set is, after all, extremely simple. It is a valve that automatically cuts alternating current in two, allowing one half of the current to flow in the circuit attached to it, and stopping the other half of the current. The reason why the crystal is generally not good for more than about 25 miles in receiving phone broadcasts, while it will receive wireless telegraph signals over vast distances, is simple.

All Depends on the Power

Everything concerned depends upon the power of the transmitting station. We rate this power in watts. Now, suppose a station has a rated output of 1000 watts—or, in other words, 1 kilowatt—so far as its carrier wave is concerned. If this carrier wave were used for interrupted continuous wave telegraphy, it would be quite possible for a crystal detector to receive the signals over a distance of 150 miles, under any conditions. But when this same carrier wave is used for the purpose of transmitting the voice or music, the distance is often cut down to approximately 25 miles. Why is this?

Because, in simple language, the amplitude of the wave used for telegraph code signals remains constant. The dots and dashes come in at the maximum of efficiency all the time. In the case of broadcasted voice and music, however, the amplitude varies over extremely wide ranges, according to the modulated output of the transmitter. This can be easily understood when you stop to notice the varying strength of tone and volume in different words and sounds uttered around you. In fact, some words can be heard and distinguished at greater distances than others.

Now, with these fundamentals in mind,

How to Take Care of Your Crystal and Test Its Quality

USE PLIERS OR TWEZERS IN HANDLING CRYSTAL.

KEEP CRYSTALS IN JAR OF CARBON TETRACHLORIDE.

How to preserve and handle crystals to keep them sensitive. Don't hold them with your hands, but use pliers or tweezers.

CRYSTAL
DETECTOR

DOUBLE THROW
DOUBLE POLE
SWITCH

DETECTOR FOR
USE
AND FOR TESTING
CRYSTALS



For emergency use or to test the quality of your crystal, attach it with a second crystal, to a double throw switch, as shown above. The comparative merits of the two crystals can then be determined instantly by switching one of them out of the circuit and the other into the circuit.

A glass cover protects the crystal from dust, while a firm rubber sponge under the detector unit acts as a shock absorber.



How to Use a Loading Coil

The loading coil which, in short wave reception, detracts from the efficiency of the set if left in the circuit may be used to advantage in reaching longer wave lengths in the manner shown above. By means of a double throw, double pole switch, the loading coil may be cut in the circuit when long wave reception is desired.

For Good Connections

To insure good contact in bell and socket types of crystal detector, solder a light flexible wire to the arm that holds the catwhisker, then solder the other end of the wire to the base of the holder.



Where to Place Fixed and Variable Condensers

The correct position for a fixed condenser is in shunt across the ends of the telephone cord lugs, where it clears up signals in the circuit. Many radio beginners have placed the condenser in series with the detector and telephone. In using the desirable double circuit tuner shown above a variable condenser should be shunted across the secondary.

here goes for the Ten Commandments for Crystal Detector Users

1. Do Not Use a Loop Aerial with a Crystal Detector. We have heard a lot of talk about hooking up a crystal set to a bed spring, a fire escape or a back fence. The sooner radio fans get these ideas out of their heads, the better their results will be. The crystal detector requires the best of aerials. It is possible, of course, for the amateur to receive radiophone concerts on a crystal with freak or loop aerials—provided he is near a broadcasting station. But for thorough enjoyment of all available broadcasts, the one

best aerial is the "T-type," and for reception on 360 meters this should have a flat top at least 150 feet in length. The lead-in should be soldered at the middle of this, and the aerial should be free and clear of all objects, the higher the better, up to 80 feet from the ground. This aerial is particularly good for the vacuum tube operator as well.

The user of the crystal detector set, however, should not employ this type of aerial unless there are a number of broadcasting stations within range of his set, and situated at different angles from him. If there is only one good station in which he is chiefly interested, the most efficient aerial

will be the so-called "inverted L type," pointing toward that station. For this aerial the flat top should be as near 100 feet in length as possible. The lead-in should be a continuation of the aerial, and should come to the apparatus from the end of the aerial nearest in direction to the broadcasting station it is desired to listen to.

2. Do Not Make Your Ground Connection with a Gas Pipe. Gas pipes are insulated at certain points for protective purposes. The best possible connection that can be obtained is upon the water pipe. Do not rely solely upon a ground clamp to hold your wire to the pipe. Carefully clean the surface of the water pipe, and then solder your ground wire to it.

3. Solder All Connections Between the Various Pieces of Your Apparatus. Soldering is necessary because it makes a continuous electrical connection throughout the set, and reduces its total resistance. Every joint is like a little door, which, if not weather-stripped, will permit all sorts of drafts to filter through. If the connections of a radio set are not soldered, there will be, likewise, all kinds of little leakages.

4. Handle Your Crystal with Care. **4. Do not, under any circumstances, take hold of it with your hands.** If you do, you will leave a film of grease on its surface which will prevent you from finding a sensitive spot for reception. If it is necessary to move the crystal for any purpose, take hold of it with a pair of round-nosed pliers or a pair of tweezers.

Make sure that the crystal is securely fastened in its holder. Cover the holder and crystal with some moisture and dust-proof material. Do not forget that if you are using galena to your crystal, the catwhisker should only just touch the surface of the crystal. Under no circumstances should pressure be applied to it. This is very important. The contact should nevertheless be firm, so that slight vibrations will not jar it from its position.

If possible, mount your crystal detector unit on a shock-absorbing device. Try heavy, resilient rubber, a firm rubber sponge, or even corrugated cardboard.

Be sure that the movable parts of the crystal holder are making good electrical connection at all times. Most of the movable parts are made on the ball and socket

The World's Most Powerful Vacuum Tube

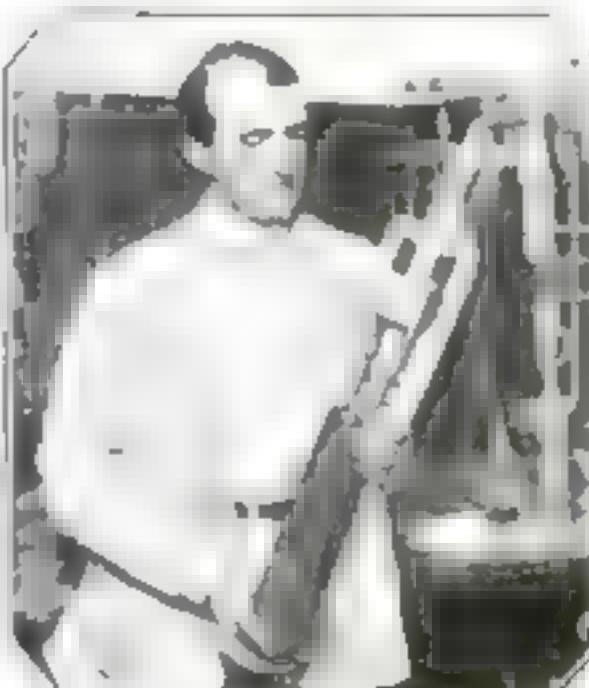
PERFECTION of the most powerful vacuum tube in the world—the 100-kilowatt giant just produced by engineers of the Bell laboratories—is undoubtedly the outstanding radio development of the month. One of these tubes would be sufficient to maintain constant wireless telegraph communication across the Atlantic Ocean, while four of them, joined in parallel at the gigantic transatlantic wireless stations, should permit continuous telephone conversations between New York and European capitals under all conditions.

Difficult Problems Solved

At first glance, it may not seem remarkable that such a powerful tube should have been developed, but experience has demonstrated that when the output of an ordinary vacuum tube is extended beyond one kilowatt, a series of practical difficulties arises, and among them are the problems of cooling the tube so that it can be kept in continuous operation, and also of maintaining the vacuum.

In the new tube, these difficulties have been overcome. The metal has been sealed to the glass, so that a variation in temperature ranging from that of liquid air to more than 300 degrees above zero Centigrade fails to sever their connection, or break down the vacuum of the tube.

Another unique feature is the system of water cooling. The plate of the tube is on the outside of the glass, but sealed to it. It is the long, dark-colored metal cylinder shown in the above photograph. In use, this plate rests in a deep socket, where water is circulated to keep the huge tube



Here is the new 100-kilowatt vacuum tube in the hands of W. G. Housekeeper, who was largely responsible for developing the water cooled tube in the Bell laboratories.

cool. Grid and filament are inside this cylindrical plate.

Not only does this new development offer immediate opportunity to bring about reliable transatlantic telephone conversation, but it brings the day nearer when we may replace with such tubes the ponderous and costly alternators now used for long-distance wireless communication and those used for power transmission, as well.

principle, and a loose connection there is a very common thing. If you are in doubt whether the arm that holds the catwhisker affords a good electrical path, solder a light, flexible wire to it, and then solder the other end of the wire to the base of the holder, where the arm is fastened. It may not look nice, but it will materially increase your enjoyment. Many times, when you are vainly searching for a sensitive spot on the crystal, investigation will show that your trouble lies in this movable arm.

If you are mechanically inclined, put two crystal detector holders on a double throw switch, and connect them in such manner that you can instantly switch one of them out of the circuit, and switch the other in. Thus, if you are in doubt about the quality of the crystal you happen to be using, you can quickly test its merits with the other crystal.

5. Don't Bow Down in False Worship to Galena. The lead that galena enjoys over other crystals in the matter of sensitiveness is more than overcome by its susceptibility to vibration. The slightest jar will loosen its contact from the sensitive point, and a considerable portion of the concert may be lost entirely, while you are searching for another sensitive spot.

Silicon, while not so sensitive, is much more rugged. The so-called Perikon detector, composed of two crystals making contact with each other, is almost as good, and less troublesome than galena. It will pay you, also, to try out carbondum. With this crystal the contacting arrangement can be screwed tightly on the crystal, so that even the heaviest vibration cannot shake it loose. However, in using carbondum, it is necessary to add a small potentiometer to your circuit, and use a dry cell, so that a low voltage can be placed on the crystal.

6. Treat Your Telephones with Consideration. Do not forget that the telephone is one of the most delicate and sensitive of all inventions. It will respond to currents which are far too small to actuate other common apparatus. With a crystal detector you cannot get results from a 75-ohm telephone, such as is used by the telephone companies. Your telephones should have a resistance of at least 1000 ohms. But remember that the resistance of a telephone is no guide to its sensitiveness. In radio, telephones are rated by the direct current resistance of their coils for the sake of convenience only. In these telephones it is necessary to have a large number of turns in the coils about the magnets, in order that the feeble currents that pass through them may actuate the magnets sufficiently to vibrate the diaphragma, and consequently it is essentially the number of turns and efficiency of the winding that determine the telephone's efficiency.

7. Do Not Overload Your Tuning Circuit. Remember that in using a crystal detector your range is extremely small, and consequently it behoves you to do everything possible to get the maximum results out of your set. If your serial tuning inductance has a large number of turns, it will cut down the efficiency of your receiver, unless in some way the "dead" ends—or, in other words, the unused portion of the tuning coil—are short-circuited.

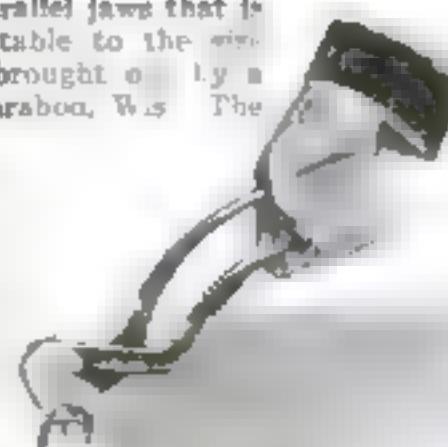
I find that a great many radio fans think a loading coil added to their tuning inductance will, in some mysterious man-

This Self-Fitting Wrench Can't Slip

A WRENCH with parallel jaws that is instantly self-adjustable to the size of the work has been brought out by a tool manufacturer in Baraboo, Wis. The wrench is made in 10 different sizes to accommodate work up to 4 inches in diameter. The principal feature of the tool is a sliding fulcrum that insures a powerful grip by causing the force of the lever to be exerted close to the load.

To use the wrench, the handles are spread apart and the jaws slipped over the work. As the handles are brought together, the fulcrum slides toward the work until the jaws are parallel. By providing this unusual long leverage, the work once gripped is held tight until released.

A flattened surface on the back of the wrench serves as a convenient hammer and one of the handles is sharpened to form a screwdriver.



Long leverage and light grasp are advantages of this new wrench



ner, increase their range. This is an unfounded assumption. Loading the inductance of a receiving set merely helps it reach longer wave lengths than those for which it was originally designed. A loading inductance, when left in the circuit while the circuit is being used for short wave reception, detracts from the normal efficiency of the set.

8. Don't Commit Assault upon the Circuit with Fixed Condensers. The only place for a fixed condenser is in shunt across the ends of the telephone cord lugs. There it forms a by-pass for the high-frequency currents which manage to escape past the crystal, and helps to clear up the signals in the circuit. Do not forget that all inductances in the form of coils have distributed capacity in their windings, and unless you place a variable condenser in the oscillating circuits, you

will not be improving your results to any appreciable extent. Capacity is very necessary in oscillating currents, but it must be carefully balanced.

Quite a number of radio fans who have been in trouble with crystal sets have sent me their wiring diagrams, and in many cases I have observed that they have placed a fixed condenser in series with their crystal detector and the telephone. This reduces the efficiency of the circuit.

9. Let Your Radio Waves Travel Only the Straight and Narrow Path. This commandment is laid down particularly for those fans who construct their own receivers. Do not place your telephones in shunt across the crystal. The only place for the telephone is in series with the crystal and the return lead to the tuner.

10. Learn How to Use Your Tuner Properly. Remember that the double circuit tuner is far better than the single circuit, in cases of interference, which it will not entirely eliminate, but will materially reduce.

By a "double circuit tuner" I refer to a loose coupler, or variacoupler. With such a circuit there are three tuning elements, and the best results are obtained when all three are properly adjusted. First, there is the primary circuit, which consists of the primary winding of the coupler in series with the serial and a variable condenser. Next, the secondary winding of the coupler, which should have a variable condenser shunted across it. And then the variation of the coupling between the primary and secondary coils of the coupler.

If you use a variacoupler, do not expect it to function perfectly without a variable condenser across it. Remember that the windings on the secondary of this instrument are not tapped in any way, and therefore cannot be varied; consequently, the variable condenser is absolutely necessary, in order to tune up the secondary circuit into resonance with the incoming signal.

\$50 in Prizes for Interesting Photos

TWO remarkable photographs combine to tell a fascinating story of engineering resourcefulness—a story of how an old, condemned bridge across the Willamette River in Oregon was used as an indispensable aid in the erection of a new steel span—and win the FIRST PRIZE of \$25 this month in POPULAR SCIENCE MONTHLY'S \$500 camera contest. The first prize-winner is Ralph J. Eddy of Oregon City, Ore., and the photographs appear on page 39 of this issue. Other prize-winners are:

SECOND PRIZE, \$15—Felix J. Koch, Cincinnati, Ohio. Subject: "Engine Winds Circus Tent on Spool" (see page 34).

THIRD PRIZE, \$10—Miss Dora Gross, Memphis, Tenn. Subject: "How Detachable Reel Holds Hose without Kinking" (see page 35).

THE monthly camera contest will be concluded with announcement of prize-winners in the January issue.

Tiny Trains Aid Engineers in Race with Flood



RACING against time in a long-odds attempt to complete a floating concrete dam across the Gila River in Arizona before floods set in, engineers of the United States Indian Bureau finished the work recently, just seven days before the torrents poured down the river bed. The dam, although of a type not previously tested, withstood the tremendous pressure so successfully that other floating dams probably will be erected where embanked dams are found unsatisfactory.

Usually, in preparing a dam site, excavations are made to "hard pan," but probes at the Gila location failed to touch solid bottom. It was decided to design a dam made of concrete slabs resting on the fine-sand river bed with precautions taken to prevent the underflow from lifting the dam and carrying it away. This called for sheet piling and an anchorage on the upstream side and a long tapering apron on the downstream side.

The dam, as finally completed, consists of a spillway 16 feet high and 400 feet long, with a concrete slab apron extending 212 feet downstream. A cement flume 42 inches in diameter passes through the spill-

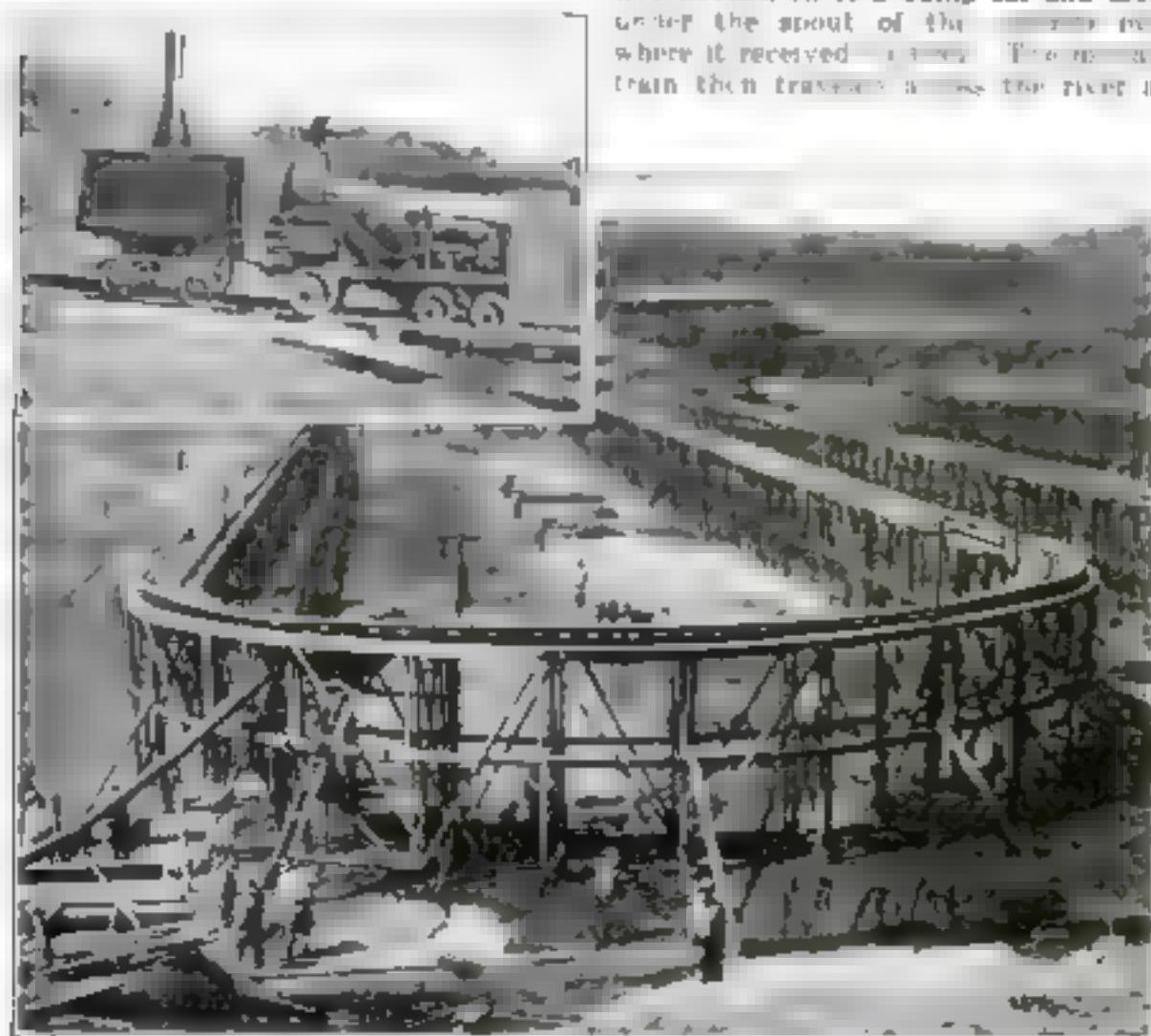
Completed, the dam "floats" on saturated sand over a wide apron of concrete slabs. Sheet piling at the upstream end anchors the structure and prevents underscoring. In the background are the sluice gates through which water passes to an irrigation canal.

way from one end to the other to supply a canal on one bank. Two rows of sheet piling were driven into the subsoil under the fore part of the dam to check the underflow. At the extreme lower end an area of rip-rap was laid to prevent undermining.

That the construction of the dam was completed in the short time available before the floods came rushing down the river, was due to the ingenious system of tramways and dump cars devised by the engineers in charge.

Two elevated railways carrying narrow gauge tracks and in the form of narrow ovals were built out into the river, and a concrete mixer was placed above the track at one end of each oval. Motive power was supplied by stripping down four small automobiles and replacing their rims with flanged wheels.

When all was ready, each little locomotive hooked on to a dump car and drew it up to the spout of the concrete mixer, where it received a load. The miniature train then traversed across the river at a

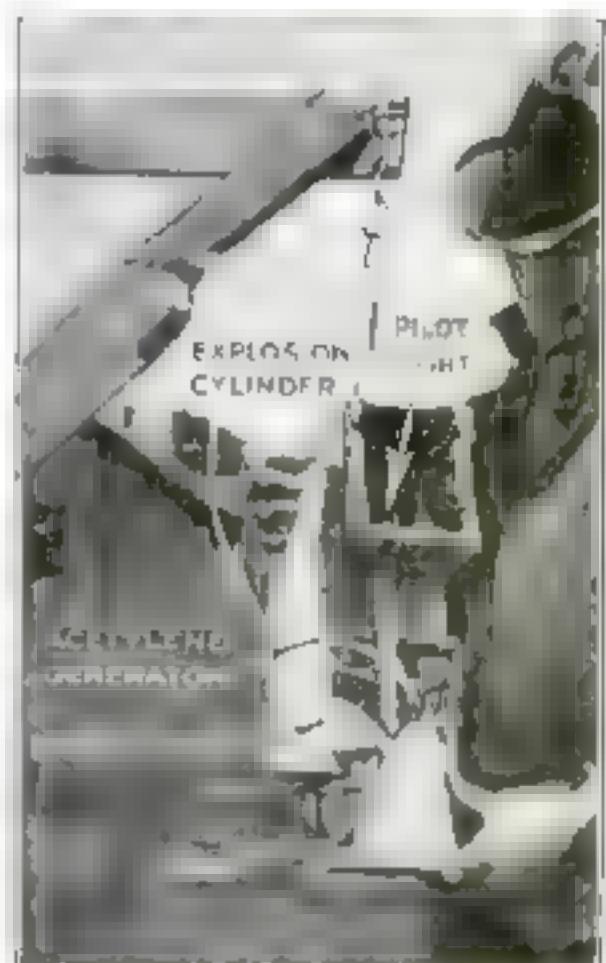


Tiny improvised locomotives (inset) sped around oval tracks, built across the river bottom, carrying concrete from mixers to forms on the floods gathered higher up the river.

surprising rate of speed to the hoppers down which the liquid concrete flowed to the slab forms. The trains made a round trip every six minutes and although the load each trip was not extraordinary, the total quantity of concrete that was handled taxed the capacity of the big mixers.

With the completion of the canal fed by the water of the Gila dam, the Government has reclaimed 62,000 acres of land.

Trout Guarded from Birds by Explosive Lantern



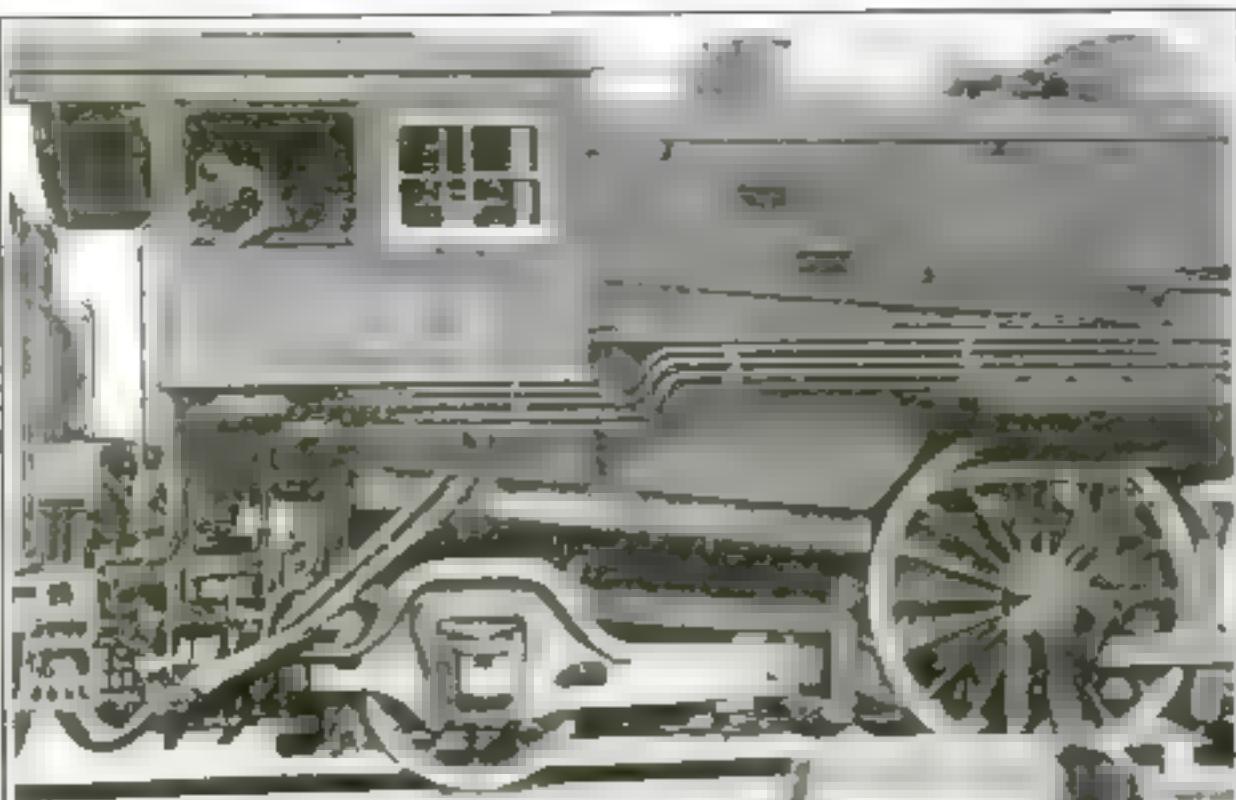
THE manager of a trout farm, on the outskirts of Salt Lake City, formerly lost many fish through depredations of herons and cranes, which made a practice of visiting his ponds during the night.

Now the trout are protected by an explosive acetylene lantern that goes off with a bang every 15 minutes. The cost of operation is less than 15 cents a night.

The larger vertical cylinder is the generator, with a two-quart water tank at the top. The carbide is placed in the lower chamber, where the slowly dripping water produces the gas.

The smaller cylinder is the explosion chamber. A small pipe, with an air inlet to modify the density of the gas, connects the two. Another tube supplies a pilot light, which periodically fires the acetylene in the explosion chamber through a vent.

Booster Helps Locomotive Make Grades

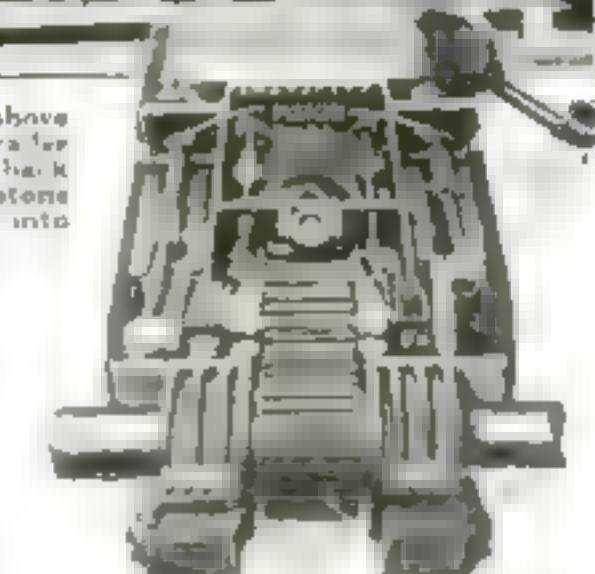


The "booster" attachment is shown above in its place on over the wheel of the trailer truck, directly under the engine cab and back of the rear drive wheel. At right: Two pistons working through gears convert trailers into driving wheels.

BECAUSE the advanced types of locomotives are approaching the weight limits of track and roadbeds, the use of the "booster" is becoming wide-spread.

The booster is a supplementary driving unit exerting its force on the trailers and utilizing them to aid the motive effort of the locomotive.

The booster is a two-cylinder engine supported upon a cast steel bed plate, which also forms the axle bearing and truck support. Weighing only 3500 pounds, the booster is said to add from



25 to 40 per cent to the locomotive's pull. It is controlled by the standard throttle, and when the engine reaches road speed it automatically disengages.

Battery Frozen in Block of Ice Is Unharmed

FRZEN inside a solid block of ice, a dry battery of new design recently drove an automobile through the streets of Denver, Colo., for five days. Special plates, a special separator, and a secret formula for the electrolyte are given by the inventors as the explanation of this unusual feat.

Following the freezing test, the battery was completely discharged, and after a few moments' rest, was recharged again by the use of the car's generator.



This test was devised to show resistance of battery to winter temperatures.



© KODAK COMPANY

Pocket Adder Calculates in Millions

SUMS up to nine million dollars may be added on a new pocket calculator only five inches long, 3½ inches wide and half an inch thick, and selling for only two dollars. The miniature machine will add or subtract as conveniently as any of the larger machines.

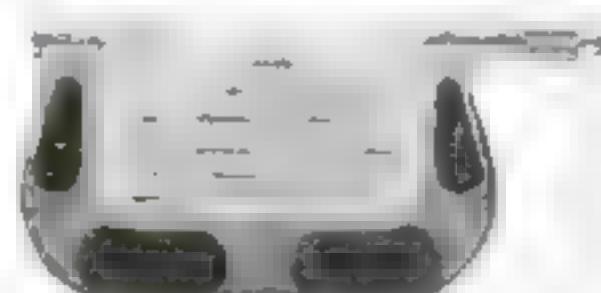
The calculator consists of nine rows of figures with a sliding slot beside each. To add, a stylus inserted in the slot opposite the number, is pushed upward. The next number is treated in the same manner, except that in case the indicator opposite the number shows red, the stylus is pushed down instead of up.



Micrometer Caliper Has Four Inch Variation

BECAUSE of the increasing number of small pistons on automobiles, a new micrometer caliper that will take measurements from two to six inches has come into wide use.

The four-inch variation is made possible by four interchangeable anvils furnished



Insertion of the proper anvil in the tool shank provides a micrometer that will measure diameters from two to six inches.

with each instrument. Each anvil is held in place by a knurled nut.

The shape of the micrometer frame adapts it to all kinds of work and makes the instrument an easy one to handle.

Six-in-One Auto Gage Worn as Watch Charm

NUMEROUS jobs around the automobile, such as setting valve tappets, distributing head points and spark plug gaps, as well as fitting piston heads and determining the correct thickness of shims, are simplified by a special six-in-one gage recently perfected.

The gage consists of six blades varying in thickness from .0016 inch to .018 inch and arranged in a common holder so that any of them may be used in combination to measure distances up to .0315 inches. An eyelet punched in the holder permits the owner to wear it on a handy chain if desired. Although accurately ground to size, the gage is ruggedly made.



This thickness gage, with its six blades, will make accurate measurements up to .0315 inches.

Designs Concrete Arches with Microscope

Scientist Invents Method of Using Frail Paper Models to Test Strength of Complicated Engineering Structures

THE skyline of America would reveal many more attractive concrete structures if engineers, instead of adhering to the staid and limiting processes of mathematical analysis, would make wider use of a new mechanical method of studying concrete buildings, according to Professor G. E. Beggs, of Princeton University. Professor Beggs' statement is based on results of tests obtained with a simple apparatus of his own invention in which he uses models of structures of which the theoretical characteristics were already known.

Paper Model Structures

The layman can hardly appreciate the immense amount of careful computation that is required from the designing engineer for even the simplest of concrete arches. Recognizing this drawback in solving so-called "indeterminate structures," Professor Beggs has worked out a method of microscopic measurements, employing celluloid or paper models that duplicate perfectly the behavior of actual structures.

The device is based on the action of a lever suspended at a point other than the center and weighted with a known weight at one end. By measuring the distance that the weighted end goes down and the corresponding distance that the free end moves up, it is possible to find the exact weight that must be added to the free end to balance the lever.

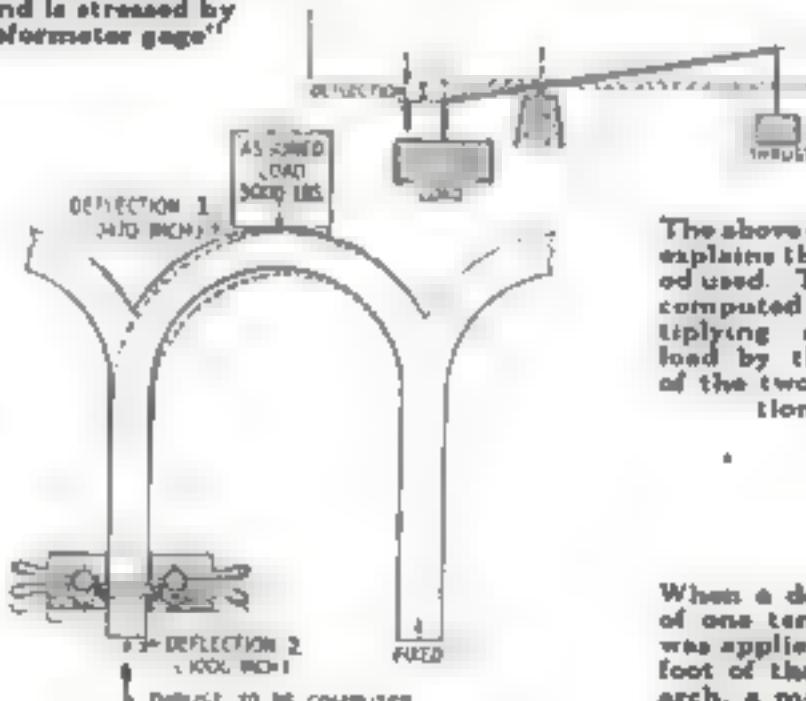
How the Model Is Set Up

When the characteristics of a complicated structure are to be determined, Professor Beggs cuts a small model from celluloid or paper, with thickness and length carefully proportioned to the original. This model, supported by bearing balls, is placed on a flat drawingboard. Various attachments are added to the model, depending on the type of structure and on the data desired. In the case of a single arch where the designer wish to know about the strains at one end of the arch when different types of loads are applied, the other end is fastened to the drawingboard, just as it would be if the arch were supported on its abutment. At the free end, a small device called a "deformeter gage" is fastened.

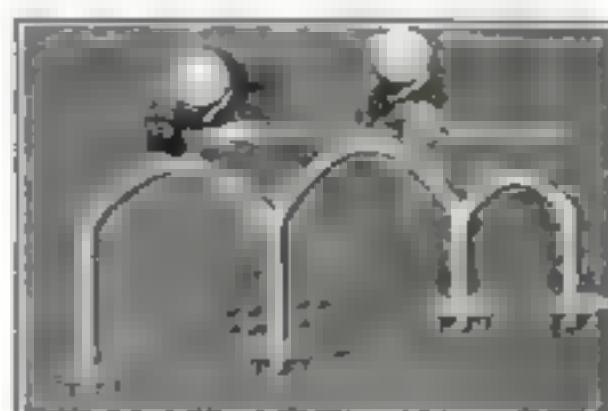
The deformeter gage consists of two parallel metal bars four inches long and .4 inch wide, arranged so that one is fastened to the drawingboard by steel pins and the other allowed to move freely. The end of the model structure is fastened rigidly to the movable member. At each side of the center line of the two bars a V-shaped cut receives gage plugs. There are five sets of



Above, Professor G. E. Beggs, inventor of the time saving system, measures with a microscope the movement of a point on the paper model as one end is stressed by the "deformeter gage."



The test pictured below is explained in the diagram above



Professor Beggs' equipment consists of a paper model, a microscope, and necessary deformeter gauges

these gages. Two sets, consisting of short rods arranged in pairs of two different sizes, are for measurement of thrust, which is the force with which the bottom end of a structure presses against the abutment or foundation. The third set is made up of two rods of different sizes and is used to measure the "moment," the term employed by engineers to describe the tendency of the structure to bend, due to a force applied somewhere along its length.

Microscope Measurements

The final set of gage plugs is for shear stresses. If one end of the footing is held rigidly and a load applied to the structure, there is a tendency of the member to slide off horizontally. This is called "shear." The shear gages are rectangular rods that fit into the V groove in the bars.

After this deformeter gage is in place, the micrometer microscope is set up over the point on which the load is to be applied. The field of the microscope is turned so that the cross lines on the field agree with the direction of the loading. Then, to measure the thrust, the normal plugs that are kept in the gage during the setting up process are removed and the set of large plug substituted. The point on which the microscope was originally trained is found to have moved. The new point is noted.

Then the plugs are removed and the smaller set is substituted. Further examination reveals another movement of the load point. Since the microscope used by Professor Beggs reads to 1/16,000 of an inch, these movements can be read accurately.

When a deflection of one tenth inch was applied to one foot of the second arch, a movement of less than half an inch was noted at the top.

The computations that follow are simple. The dimensions of the plug gages are selected so that the movement caused by their insertion is of a known amount. Combining this figure with that obtained from the microscope reading, the result is a ratio determining the pressure on the foot of the arch, caused by one pound of load applied at the top.

The total pressure at the footing of the arch is then computed by multiplying this ratio by the total load that the arch should be designed to withstand.

A Page of Novel Photographs from the News of the Month



An Aeromobile

Fifty miles an hour is speed of the propeller-driven "aeromobile" shown above. It has a top speed of 60 miles an hour.

Paris Road Brush

The typewriter set up at the right is being used to type a road brush. The typewriter is being used to type a road brush.

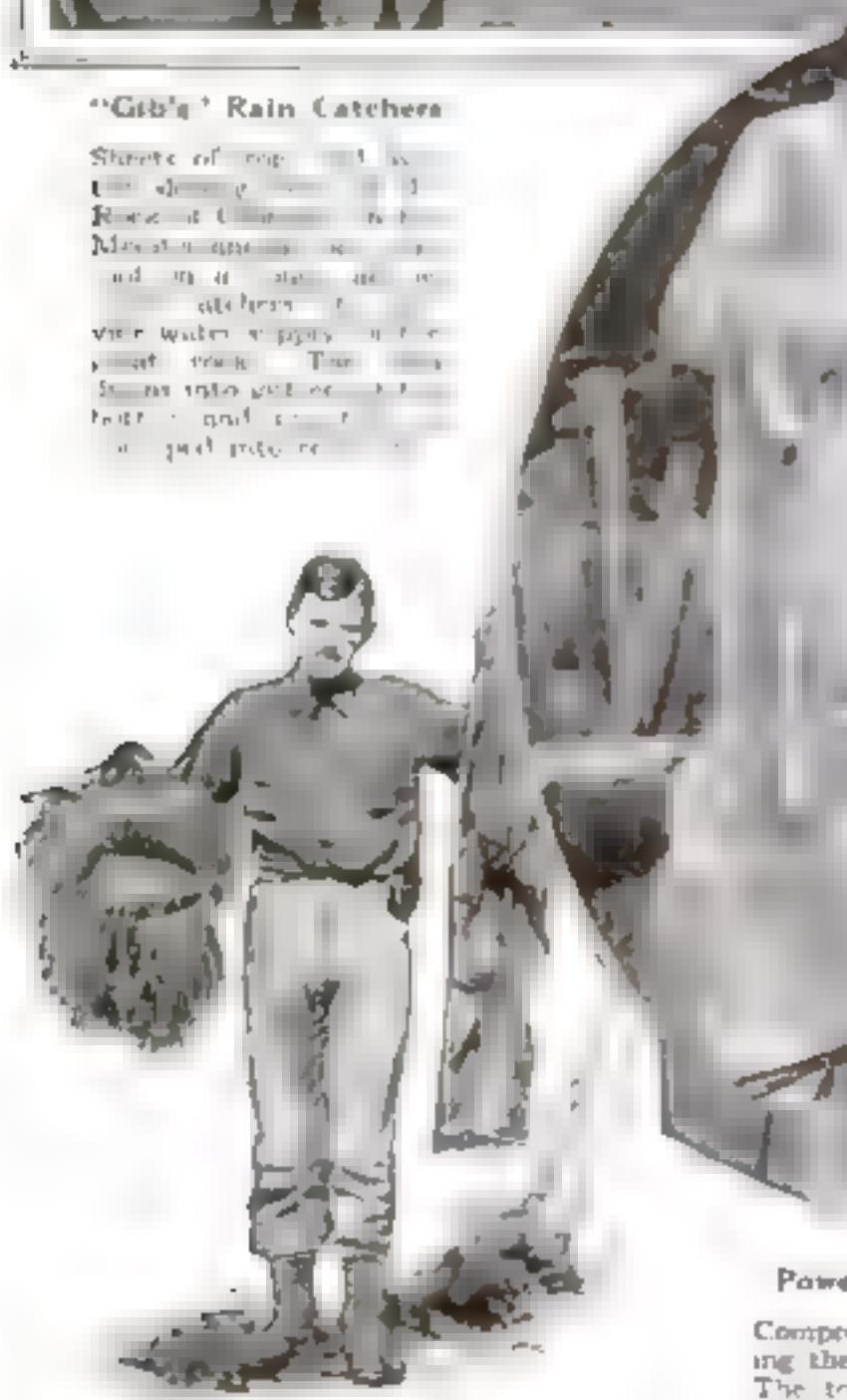


"Gib's" Rain Catchers

Sheets of copper are being draped over the roof of a house to collect rainwater. The metal sheets are being draped over the roof of a house to collect rainwater. The metal sheets are being draped over the roof of a house to collect rainwater.

Just like Tin Roof

The typewriter set up at the right is being used to type a road brush. The typewriter is being used to type a road brush.



Power Tool Aids Sculptor

Compressed air tools are replacing the hand mallet and chisel. The tool shown above derives its power from a small gasoline engine and air compressor in the studio. Not only greater speed, but finer work is possible with the power tool, it is said.



This all-steel spiral slide, with two complete turns, and a sliding distance of 35 feet, is proving popular.

This Colorado naturalist displays two cherished possessions: a porcupine's skin and old overalls with wasp nest "built in."

Steel Patches Mend Rusted Pipe Line

PATCHES of steel plate, applied like plasters to weak spots and securely welded in place, recently effected repairs to a 3000-foot water pipe line in Honduras, South America, saving the cost of rebuilding the entire line.

This 22-inch pipe line, which supplies the Guadalupe plant of the Honduras Rosario Silver Mining Company, had been in service for many years. During that time most of it had lain on top of the ground, and was badly corroded. Examining the sections previous to the start of the work, the engineers discovered places where the sheet steel had been rusted to the thinness of ordinary paper.

The line was constructed of one hundred 30-foot sections riveted together in 90-foot lengths, equipped at the ends with connecting flanges. Removal of the corroded sections was not advisable because of the

Below: Welding a steel patch on a section of pipe under a protective awning.



Above: A section of corroded pipe, showing numerous steel patches welded over weak spots by the portable welding machine shown at right



weakness of the riveted joints, while the rugged nature of the country made transportation of new pipes for replacement an extremely expensive undertaking. It was finally decided to make repairs by the use of portable electrical arc welding outfits manned by native workmen.

Patching Saves Expense

First, the pipe line was disconnected at every third joint, so as to leave 90-foot sections of continuous pipe in each piece. These sections could be easily turned around on the tiers on which they were originally stalled. Engineers examined every inch of the pipe and marked the weak spots. Then at each weak spot a piece of steel plate of the proper size was formed to cover the marked area. Around the edge of this plate the welders deposited a fillet of metal, producing a tight, tough joint.

After the work was completed, the pipe line was tested with double pressure. Only a few leaks appeared, and these were promptly closed with blows of a capping hammer. It is estimated that the repairs were made at one tenth the cost of replacing the entire line.

How the portable arc welding equipment, weighing 1500 pounds, was hauled over the mountainous country of Honduras, South America to repair the pipe line

Talking Machine Phones Height of Water in Reservoir

BY COMBINING the telephone and phonograph, an English firm has perfected a novel device that automatically announces in either words or code signals the height of water in a distant pond or reservoir.

The recorder can be "run up" or switched into any existing telephone or telegraph circuit when information about the height of water is sought. As installed, the new device consists of a phonograph mechanism with a phone transmitter substituted for the sound box. An electric motor drives the record table, and a relay, acting through levers, stops and starts the machine and lifts the needle from the record.

Float Controls Recording Needle

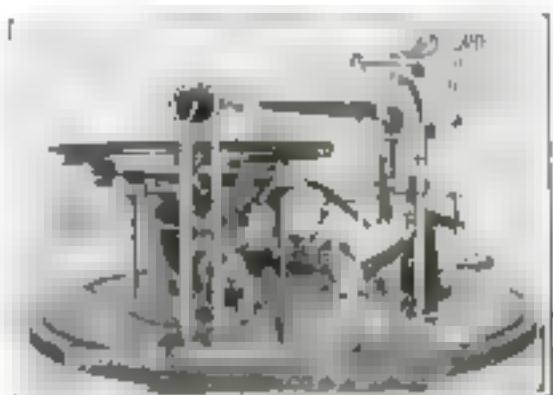
The recording disk contains 200 concentric grooves, each groove a vocal record of a certain height of the water. By the movement of a float that rests on the water, the tone arm, sound box, and recording needle are moved laterally into position with the disk in such a way as to give the correct reading when the needle is brought into contact with the disk.

To effect this contact, the sound box, with needle, is automatically lowered when the disk mechanism is in rotation, and raised again above the disk when the mechanism stops.



How the talking instrument, with telephone transmitter substituted for sound box, is installed at the reservoir

The instrument is connected in the usual way with the nearest telephone exchange, and is given a regular subscriber's number. When the inquirer seeks information about the height of the water, he asks Central for



In response to a phone call, this mechanism automatically starts a phonograph record that telephones the water level

this number. As soon as the instrument phone rings, the needle immediately drops to the record, which makes three revolutions, and a voice announces over the telephone line the exact height of the water. The short "speeches" on the record range from "empty" to "one, double nought," enunciating each digit of a figure, such as "seven two" and "seven two half." The mere ringing of the phone sets the mechanism in operation, delivers the spoken information, and closes the recorder.

In the code signal type of mechanism the grooves on the record contain various combinations of dots to represent the changing height of the water.

Office Safes Survive Terrific Roasting in Test Oven

Novel Theater Audience Sees Undamaged Papers Removed from Improved Steel Cabinets After Dramatic Ordeal of Fire

FIVE hundred salesmen, their eyes focused on one point, gaze with eager interest and suppressed excitement as a white hot steel safe, weighing half a ton, is drawn from a roaring inferno of fire and quickly swung three stories in the air. They hold their breaths during the short interval in which the crane man gathers his strength for a powerful jerk at the release rope. Dropping like a fiery meteor with a trail of scintillating sparks, the safe turns over slightly in its flight and crashes, corner first, on a pile of broken bricks. Two laborers rush in with a streaming hose and play it on the mass of hot steel, enveloping it in a haze of hissing vapor.

Heat and Fall Leave Safe Intact

Soon the clouds of steam thin and operators equipped with asbestos gloves approach the safe and open the door. The theoretical conflagration is over and the safe, after subjection to a heat seldom attained in ordinary fires, combined with a fall such as might conceivably take place when floors collapse during the height of a devastating fire, is seen to be still intact, with its contents of inflammable paper showing no signs of the fire it has been through.

Such is the spectacular demonstration staged periodically for visiting salesmen and executives by a progressive manufacturer of a fire resistive safe. So valuable have these tests become that a special laboratory has been built in Marietta, Ohio, where new models of safes are subjected to similar rigid experiments. Equipment has been added by purchase or by invention that will simulate every known condition that safes must withstand in actual configurations.

It was a Methodist minister who, some 15 years ago, conceived the



Are Modern Office Buildings Really Fireproof?

PAPERS containing records valued at more than \$5,000,000, locked in safes that were relied upon to be fire and burglar proof were burned to cinders in a \$15,000,000 fire, illustrated above, that recently swept the upper stories of the Burlington office building in Chicago, also believed to be fireproof. This disaster—called at the time America's first serious skyscraper fire—instantly raised a question among engineers as to the safety of huge modern office buildings hitherto supposed to be completely fireproof.

Subjected to the terrific heat from blazing buildings 80 feet away, the wooden window sashes of the Burlington Building were first ignited, and their destruction opened the window spaces to the full effect of the fire. Even window panes with wired glass

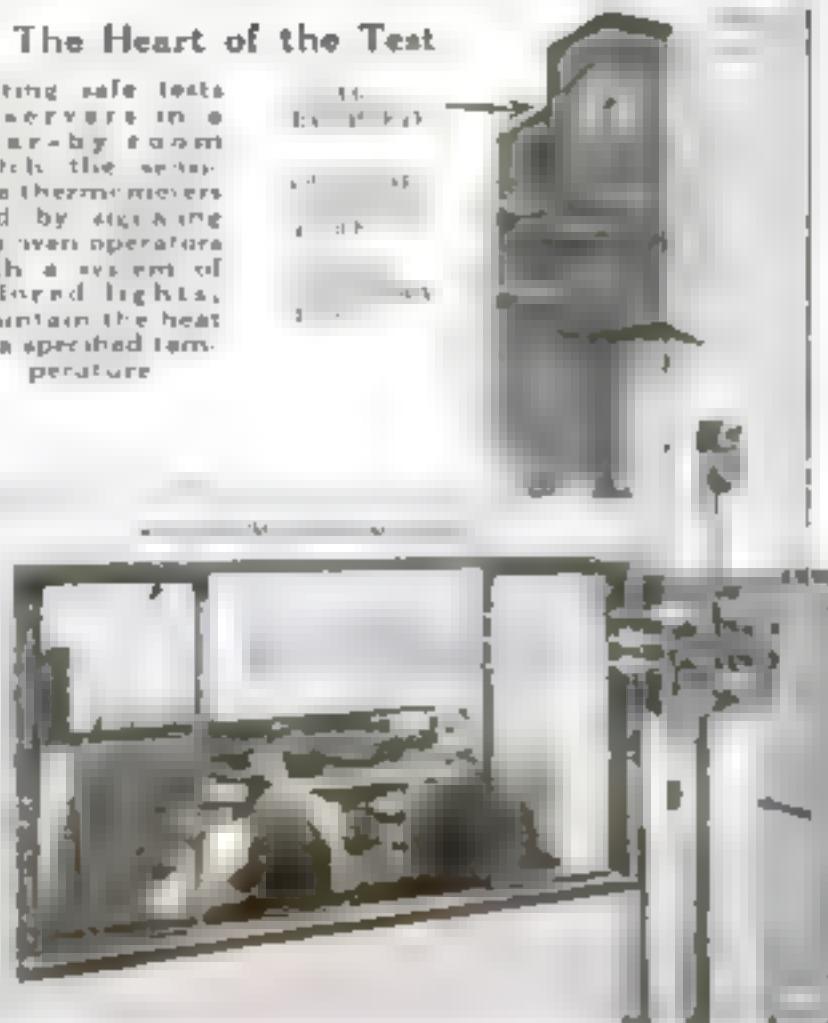
melted and pulled away from the frames.

Thus breaking into the building, the flames found ample food in the wooden desks, doors, and cabinets of the interior, while the wooden trim of the so-called fireproof partitions was the means by which they spread throughout the building.

The disaster indicates that no building is proof against the ravages of fire as long as its contents—furniture and trim—are inflammable. The fireproofing of vital records, therefore, becomes of importance, and the reason is seen for the seemingly elaborate tests administered by an American safe building company to its products. The spectacular tests are no more severe than conditions actually encountered in the Chicago catastrophe.

The Heart of the Test

During safe tests observers in a nearby room watch the sensitive thermometers and by signaling the oven operators with a system of colored lights, maintain the heat at a specified temperature.



Idea that a safe might be constructed that would be not only lighter in weight and greater in capacity than the old style iron safes then commonly in use, but also absolutely proof against destruction by fire. This man realized, as many others never have, that the contents of a building are not included when the term "fireproof" is applied to a structure. For while fabricating materials such as concrete and steel, with which a building is erected, may be proof against fire, the furnishings and equipment of buildings are usually of the most inflammable nature.

Person's Idea Is Successful

After wide research and experimentation the Methodist minister completed a safe that under test proved to be all that he hoped. But though convinced himself, he found that salesmen and prospective purchasers still retained a measure of doubt that these light weight safes could do all that he claimed. So the testing laboratory and the spectacular tests were called into existence.

Previously safes had been tested by placing them in wooden huts and igniting the huts, but such tests were not exact imitations of conditions encountered in real fires. Test conditions could never be duplicated; results varied with the wind, and there was no way of surrounding the safe with burning gases.

Details of the Test

The most important apparatus at the present testing laboratory is a huge oven that can be heated to temperatures as high as 2000° F. by burners supplied with a special grade of high temperature gas delivered through a six-inch main. Air blowers supply the air for proper combustion of the gas.

After the safe to be tested is stuffed with books and loose papers to simulation of the customary office safe, several sensitive thermometers, called "thermocouples," are placed at selected locations inside the safe and outside in the oven. The safe is then locked, the oven door closed, and the burners are lighted.

At the end of five minutes the thermocouples register a temperature of 1100 degrees; five minutes more and the heat

has increased to 1400 degrees; at the end of 30 minutes the heat within the oven stands at 1650 degrees; and finally, after two hours, a top temperature of 1950 degrees is recorded.

Through mica peepholes in the oven side, the safe appears as a mass of flaming red steel with burning gas enveloping it from top to bottom. In a near-by room observers watch the thermocouple readings and maintain the heat at the predetermined temperature by signaling the oven operators through a system of colored lights.

After the completion of the heat tests, the safe is withdrawn from the oven. A crane hooks it, then lifts it 40 feet in the air. It is released and dropped on a



Rods containing thermometers are placed around the safe to indicate the oven heat

pile of broken bricks. Following this crashing fall, the safe is returned to the oven for a second period under high temperatures. This reheating is supposed to imitate the roasting undergone by the safe after it has fallen through a collapsed floor into a mass of burning debris. After an hour the safe is again withdrawn from the oven and cooled by streams of water.

Not all the safes are tested in the presence of thrilled audiences. The staff at the laboratory is constantly at work on

routine tests, the results of which will tend to improve the quality of the product. Every 60 days a number of safes of all sizes are taken at random from stock and subjected to the most strenuous tests.

The rating is based on an arbitrary standard selected after an experiment conducted by M. L. Carr, director of the laboratory. Under his supervision, sheaves of printed paper were placed in an oven and slowly roasted. As the temperature increased, the condition of the paper was

noted through the glass front of the oven. At 500 degrees the paper had charred to a point where the writing and printing were illegible. Three hundred degrees was therefore selected as the limiting temperature that should be permitted in a safe.

Based on this standard, a safe that shows an inside temperature of 300 degrees after exposure for two hours to an oven temperature of 1950 degrees, is classed as a two-hour safe. A three-hour safe can stand off the 300 degrees inside heat for three hours.



Before a gathering of television and buyers, the white-hot safe, heated to the ceiling, plunges 40 feet with a spectacular crash onto a bed of broken brick.

Unusual Flying Boat Has Hull and Wings of Duralumin

OUTSTANDING in its design because of its light weight, casehardened metal body and the elevated position of its engine, the flying boat designed by Herr Dornier, Zeppelin designer, represents the latest advance in combination water and air craft.

The specially prepared duralumin of which the hull of the boat is built, is processed to protect it against the corroding effects of salt water. The engine is located high in front of the pilot, out of the way of the salt water spray.

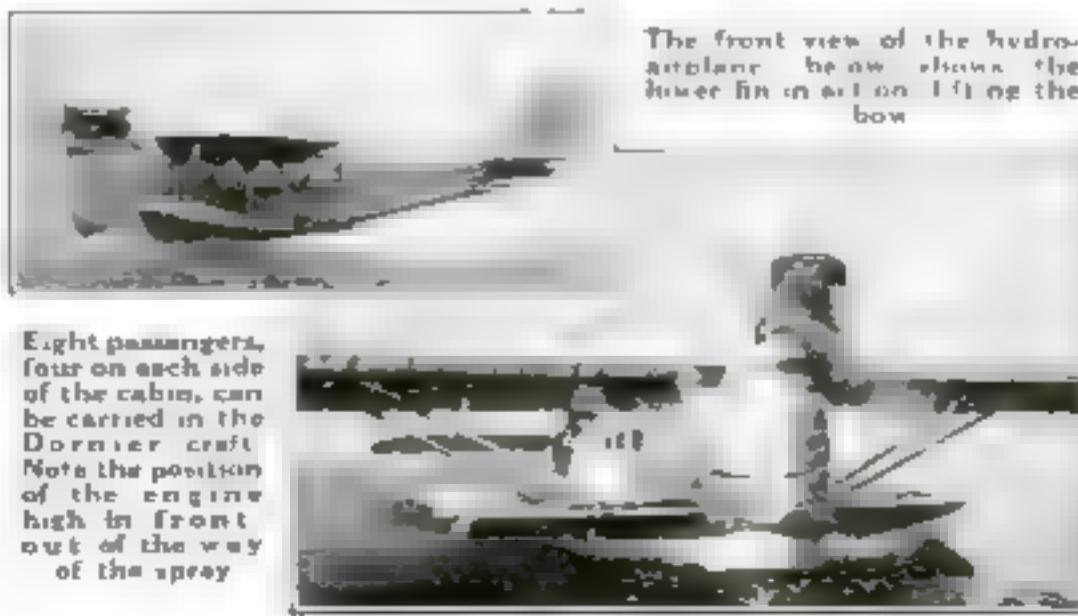
The top wing is unusually thick—in fact, it is a modification of the

popular cantilever wing form. It will be noted, however, that this heavy wing is rigidly supported by stout diagonal struts

from the lower wing surface. The lower wing acts like a huge fin, performing a double duty as a lifting surface, both in the water and in the air.

The cabin of the plane offers comfortable accommodations for eight passengers. The pilot's cockpit is in the nose of the machine.

The sturdy flying craft appears to be well adapted for cross country serial transportation service, using lakes and rivers as landing fields.



Eight passengers, four on each side of the cabin, can be carried in the Dornier craft. Note the position of the engine high in front out of the way of the spray.

If you want to attract the birds, plant the right trees and shrubs. Red cedar, the native flowering dogwood, and Virginia creeper are best.

Pipes Laid with Drills to Save Lawns

USING compressed-air driven drills and extension rods, a light and power company in Brooklyn, N. Y., has found it economical when installing electric light supply lines to bore holes from cellar to street rather than to dig trenches as is usually done. Distances up to 40 feet have been successfully covered by this method.

The cellar wall is first cut through with a chipping hammer. Then a drill, such as is used in coal mines, is inserted in the air hammer and the ground perforated for a distance of 10 feet, which is the limiting length of the drill. For longer distances extension rods are added to the drill. Compressed air is supplied by a gas-engine driven air compressor, mounted on a trailer and drawn by the truck accompanying the working crew.



Inserted through a gap in the cellar wall, the compressed-air drill bores a tunnel for the pipes.

Seventy-five per cent of the jobs can be handled in this way. The drills have been successful in pounding their way through all kinds of obstructions except round boulders. When these are encountered, a slight change in direction of the opening is usually effective in passing around the obstruction, enabling the drill to continue its work.

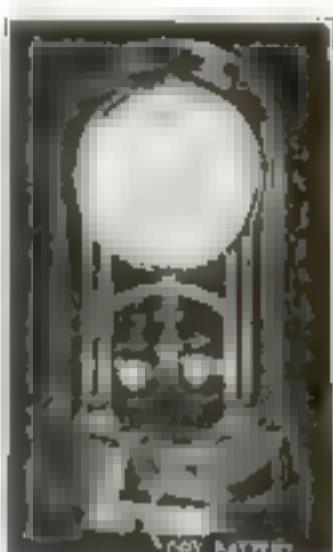
Dry Cell Swings Pendulum of "Never Wind" Clock

"PUT out the clock, wind the cat, and 'come to bed'" as a night-time admonition may soon be scrapped by the perfection of a clock that keeps step with the minutes month after month practically without attention. George S. Tiffany, of Summit, N. J., the inventor, calls it a "never wind" clock.

The principal parts of the timepiece are a small dry battery located in its base—renewed once a year—an electromagnet, and a torsional pendulum. The dry cell takes the place of springs or weight.

To start the clock, an initial impulse is given the pendulum with the hand. The movement of the pendulum opens and closes the circuit of the electromagnet, supplying the pendulum with the impulses that swing it forward and backward. With each of these movements the wheel of the clock is moved a distance of one tooth. Since the pendulum does no direct mechanical work, the friction is reduced to a minimum.

Except occasional regulation, the clock requires only a yearly renewal of battery.



A dry battery takes place of springs

Vines Planted with Aid of Electric Drills

BY THE use of an electric power drill, a Californian grape grower has devised an ingenious method of planting his 200 acres in record time.

From a near-by power line, an insulated cable long enough to reach every part of the planting area was extended by permission of the power company. Four 1½ horsepower electric drills, each fitted with a three-inch auger, were then connected with the portable cable. One man was detailed to look after the cable and another to operate the drill. A third placed the grape cuttings in the



Attached to a portable wire from a power line, the drill bores holes for the grape plants

holes and tamped the earth around the roots. It was an instant's work to drill a hole 14 inches deep, ready for the plant.

Not only was time saved in planting, but the cost was much reduced.



Six Shooter Is Combined with Flashlight

BY COMBINING a flashlight with a six shot revolver, S. P. Cottrell, of Buffalo, N. Y., has produced a weapon that is particularly valuable to night watchmen.

The barrel of the gun is fastened to the top of the flashlight tube, and the magazine holding the six cartridges is within the tube.

The gun is fired by a standard trigger protruding through the bottom side of the flashlight.

The light may be used either separately or in combination with the weapon in case of emergency.

Pocket Radio Set Tips Off Stock Brokers

A MYSTERIOUS leak-age of secret information from the stock exchange to curb brokers was recently traced by an officer of the San Francisco detective force to a member of the exchange who



carried a miniature radio transmitter strapped around his waist.

The batteries were carried like gun cartridges in a belt around the man's waist. Also around his waist were many turns of insulated copper wire used for the aerial.

Signals were sent by a muted buzzer operated by a miniature telegraph key concealed in a side pocket. Code signals could always be caught by a supersensitive receiving set in the near-by broker's office.

Explorer Finds Strange Relics of Lost Race



These strange symbols, made up of several layers, extend along the face of the cliff for nearly half a mile.

FLAT boulders of volcanic lava, mysterious caves and secret mounds, covered with pictorial inscriptions that may have been the work of America's earliest inhabitants have been discovered in a deserted section of Owyhee County, Idaho, by an exploring party led by Robert Limbert, of Boise.

Few of the symbols have been recognized by native Indians as those of their ancestors, the notorious Shawnee tribe that roamed the Idaho plains before the white man came from the East; but most of the writings, from their appearance and description seem to ethnologists to be the work of natives hundreds and perhaps thousands of years ago.

More than 30 acres of rocks in the sage-covered plain near the junction of Battle Creek and Deep Creek in southwest Idaho are covered with hieroglyphics.

Two distinct types of rock writings have been found. One is the ideograph or sign type, similar to those discovered on the ancient rocks of China; the other is the pictograph type, used extensively by the early Indian tribes of America.

Most of the writing has been done on flat or sloping rocks, but in one place Mr. Limbert discovered an interesting variation. A lava cliff that formed the south wall of a grassy plain was covered for nearly half a mile with thousands of mysterious inscriptions. In many places the ideographs had been overwritten with pictographs.

The mysterious mounds that were found near by may contain relics of inestimable value. These mounds, 20 in number and all pointing north and south, are from three to four feet wide and from two to three feet high.

In the same vicinity are strange caves that have never been explored. On them



Robert Limbert, of Boise who while exploring a wild section of Idaho, stumbled across the rock carvings that may be the key to the earliest American history.

and around them are arrows pointing like on ancient "follow the arrow" game. Usually a series of arrows terminates at one of the mounds or cave openings.

Near one large rock covered with undeciphered inscriptions Mr. Limbert discovered a small pile of broken rocks with



Another rock covered with mysterious symbols. Note arrow leading over ridge of rock to unexplored cave near by.

openings through which a draft of air blew continually, suggesting a second opening at some other spot. On a cold day in winter the moisture in this steady blast of air condenses to feather-like steam etc. In some of the smaller of these rock piles a quantity of decayed grass matting was found with several flat broken and crumpled pieces of dried earth.

Some of the carvings of pictographic symbols have been shown to Mr. John E. Reed, whose associations with the Indian tribes of that section have continued for half a century. One of them, as translated by Mr. Reed, designated the grave of a favorite chieftain and described at length those feats of valor that had caused him to be highly revered by his followers.

Are these symbolic records the work of a race of people who preceded the cliff dwellers, Mayas, Aztecs, and Incas of Peru? This interesting problem cannot be solved until the mounds are explored and the strange markings deciphered.

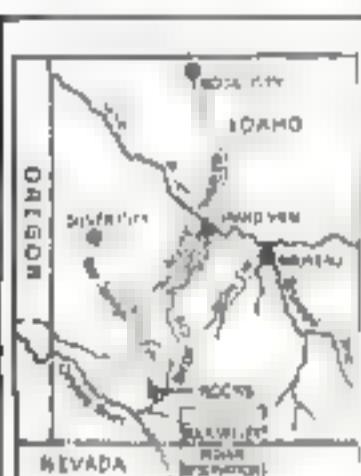
Frail Canoe Supports Heavy Weight



The weight of seven men added to the ton load of heavy sand failed to buckle this canoe built of thin layers of veneer.

TO DEMONSTRATE the strength of a new style canoe built of veneer, it was subjected recently to a weight of 3420 pounds. The sag was only three-

quarters inch. By making the veneer in long sheets, the canoes are molded without joints below the waterline, except at the ends.



Route followed by the Limbert party and the spot near Battle Creek where the writings were discovered.

To This Child Musical Sounds Have Color!



Edgar Curtis, age 3½ years, picking out the colors he sees when different notes are struck on the piano.



A SCOTCH woman with a broad "hurr" in her speech was reading a story not long ago, to little Edgar Curtis, age three years and seven months, the son of Professor and Mrs. O. P. Curtis, of Cornell University. When the story was ended, the child said to his mother,

"Do you know what color it is when she reads? It's black."

A brilliant rainbow brought keen delight to the boy:

"A song, a song!" he exclaimed.

And so was revealed one of the most remarkable cases of "colored hearing" that



Edgar finds that C sharp on the guitar is "black," while on the piano it makes him feel "red." His color sensation thus changes with the timbre of the tone. Diagram at left shows how closely the centers of hearing and sight are associated in the brain.

"Edgar often goes to the piano, and to amuse himself, touches the keys and tells the colors of the sounds," she writes. "Middle C he calls red, and the tones just below, red or red purple. The bass 'looks' black to him and the high tones white. Between middle C and the white tones he 'sees' reddish and bluish ones."

Edgar never of his own accord named tones yellow, green or gray; but during some later experiments when shown these colors he found tones for them all.



When disengaged, the hammer thrusts a hardened steel ball into the metal to be tested.

Small Spring Hammer Tests Hardness of Metal

MACHINE shops that cannot afford the expense of a Brinell hardness testing machine may utilize an apparatus, said to be of equal accuracy, invented by Richard Baumann, of Stuttgart, Germany, which consists of two telescoping tubes. As the rear tube is pushed forward, a steel hammer in the interior is submitted to the thrust of a spring, and at the given instant, which can be adjusted by the operator, the hammer is disengaged. Flying forward, it strikes an anvil and thrusts a hardened steel ball into the material to be tested.

The remainder of the test is the same as the Brinell process. The diameter of the imprint is gaged by a microscope, and the hardness and strength of the material are derived by a formula. The new tool can be used both on small and large pieces, and as it has two thrusting functions, it may be used either on soft metal or steel. The friction of the moving hammer is negligible, since it moves on a very thin spindle.

The tool is so light and small that it can be used as a traveling outfit, or even be employed to test each piece individually without removing it from the lathe.

Engine Winds Circus Tent on Spool



Huge, motor driven spools, on which circus tents are wound after the show is over are among the most recent of the time saving devices which circus managements have developed amazing speed in setting and "pulling up stakes" during one-day stands.

When the circus has completed its exhibition and before the last patron has left the grounds, the spool, mounted on a special wagon is backed up to the big tent, and one end of the canvas attached to the spool. The motor is started and the canvas slowly wound around the drum.

At the next stopping place a team hooked to the canvas quickly unwinds the tent.

When the show is over, thousands of yards of canvas are wound on huge motor-driven spools. Inset shows a team of horses unwinding a big circus tent from one of the spools mounted on a large truck.

Working Single Handed under Water, Diver Mends Ship's Bottom by Use of Pattern Patch

Remarkable Repair Job Completed in a Week without Drydock

SEVEN days after a submerged anchor had ripped a jagged hole in the bottom plates of the Japanese steamer *Tamon Maru VIII* as she was leaving the harbor of Newcastle, Australia, recently with a full cargo of phosphates, ingenious ship mechanics and intrepid divers, working continuously, had built a coffer dam around the break and applied a four-foot patch that failed to show a trace of leakage.

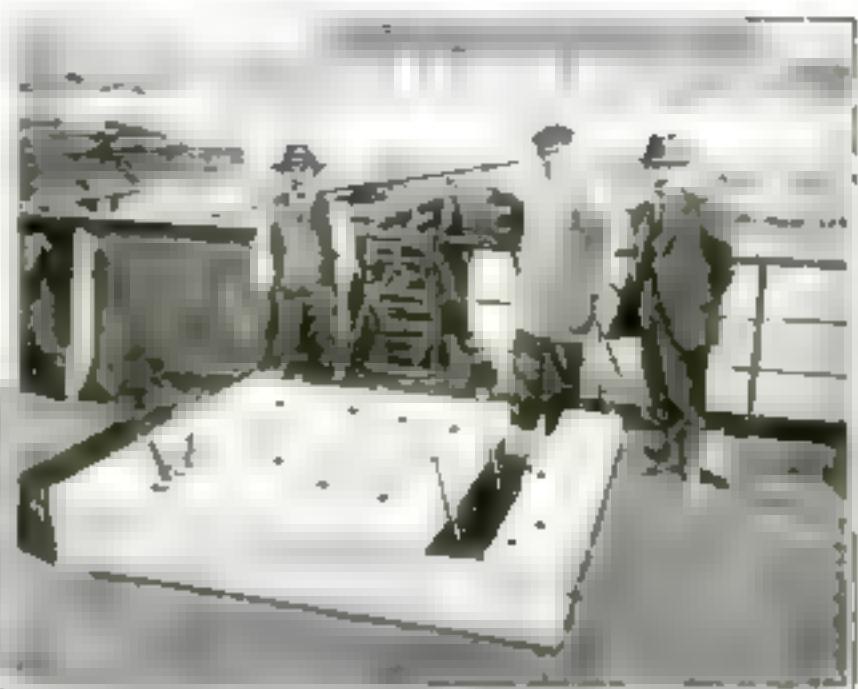
The feat was exceptionally remarkable for the fact that, since Newcastle has no drydock, it was necessary to survey the damage, make an exact pattern for the patch, and complete the repairs under water, while the big vessel floated beside her dock. The *Tamon Maru VIII* is 327 feet long, with a beam of 41 feet, and gross tonnage of 2977 tons.

All that had saved the vessel from sinking was her double bottom, as the collision ripped a jagged hole in the outer shell. Before the work of patching the hole could be undertaken by a diver on the outside and by men working between the false and the outer bottoms, it was necessary to clear the space of water and close the hole temporarily.

The damaged portion of

holes through the undamaged sections to receive studs for fastening the patch, and finally tapped and fitted seven-eighth-inch studs, about four inches apart.

When all the studs were in place, the manholes were closed and a diver descended



To permit repair work within the vessel's flooded ballast tank, a coffer dam of heavy timbers, shown above, was bolted by a diver to the bottom of the hull over the hole. The tank was then pumped dry



described a circle on the template around each stud, from which the exact center of each hole on the final patch was later determined.

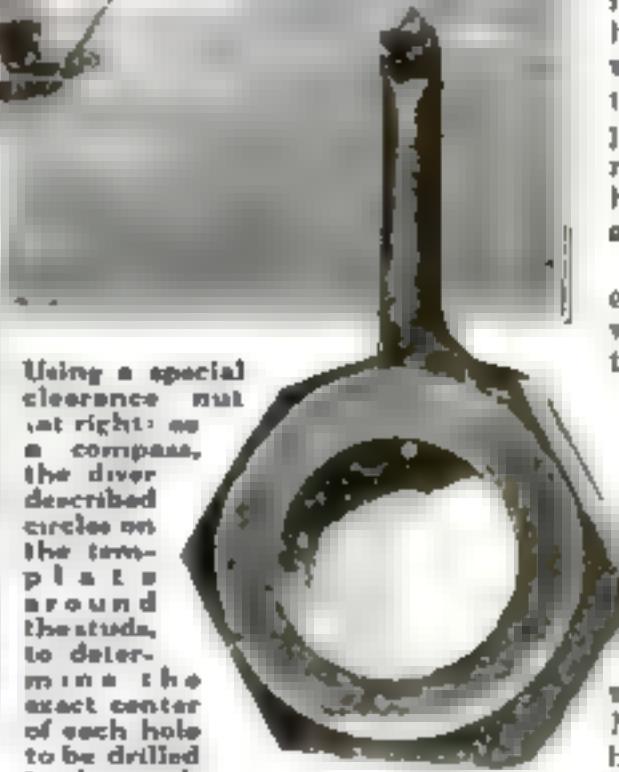
So successful was this method that although the holes in the patch plate were drilled to a tight fit, the patch slipped over the pilot studs and the 34 remaining studs without a hitch. The diver tightened all the studs to the limit.

Then, as water was pumped from the ballast tank, water pressure from below the hull forced the plate closer to the ship's bottom, while the diver took up slack.

To complete the work the plate on the inside was covered with a four-inch layer of cement, producing a patch so strong that the *Tamon Maru VIII* was given a bill of clearance from the port officials permitting it to proceed to any part of the world.



The patch plate, with holes drilled on centers determined by the diver's template, ready to be fastened on studs tapped through the ship's bottom



Using a special clearance nut at right as a compass, the diver described circles on the template around the studs, to determine the exact center of each hole to be drilled in the patch

the hull, about four feet six inches on a side, was first surrounded with a coffer dam, about six feet square, built of heavy timbers. By means of hook bolts, this dam was fastened to the hull by a diver. The space between false and outer bottoms was then pumped dry and an emergency entrance was cut from the tunnel through which the propeller shaft passes.

All was now ready for the actual work of preparing the patch. In cramped quarters between the floor of the hold and the outer plates, workmen removed the damaged portion of the plates, then drilled

ing again below the ship's bottom, removed the coffer dam from the outside and prepared to measure the patch.

It was essential that the holes to be drilled around the edges of the patch should fit exactly over the studs protruding from the bottom of the hull. To this end, a template was prepared from rough measurements, with holes drilled sufficiently large to prevent any trouble for the diver in slipping the template over the studs.

Having placed the template in position over the hole, the diver, with the aid of a special, compass-like clearance nut, de-



Cross section of ship's stern, showing ballast tank where workmen made repairs, and protecting coffer dam

Radical New Shoe with "Automatic Fit" Promises Us Relief from Common Foot Troubles

Manufacturer's Scientific Shoes Based on Natural Foot Shape

By Robert E. Martin

THE neglected cause of a multitude of human ills—badly fitting shoes, which statistics show are worn by from 70 to 90 per cent of our male population, and which, science has lately proved, produce serious bodily disorders and actually gravely impair many a man's earning power—may be remedied by a radical change in shoe design now being developed in Rochester, N. Y.

After more than half a century in which machine-made shoes have been the standard American footwear, designed rather for appearance and economy than health and comfort, Oliver E. De Ridder, vice president of a great shoe manufacturing plant, has invented a new style of last that ingeniously adapts the inner sole of the shoe to the delicate contour and structure of the human foot. Mr. De Ridder made thousands of molds and measurements of feet during seven years of research work, before the new, specially shaped lasts were perfected.

What's Wrong with Modern Shoes?

That modern shoes, manufactured in quantity, and so designed as to crush the wearer's delicately curved sole against a flat surface, are really the fundamental cause of innumerable foot troubles, was the theory from which Mr. De Ridder started.

"All modern shoemaking machinery," he says, "is standardized and designed to the use of a last which is flat-bottomed. It does not attempt to fit lateral arches, and its heel tread is flat, or nearly flat. It is designed to produce inner soles that are practically flat. The channeling and welting ma-

A Rebel Shoemaker's Message for You

THIS modern shoe carries its own condemnation with it—in the shape of no less than 126 devices now on the market for remedying the defects that it has caused in the human foot. Flat foot and the hundreds of other troubles that affect wearers of the ordinary shoe are caused by the struggle of the foot to accustom itself to a hard, flat sole that does not allow the joints of the foot free play."

This verdict of Oliver E. De Ridder, inventor of a revolutionary method of molding shoes to fit the natural curves of the human foot, comes with the authority of an expert who has examined and measured the feet of thousands of men and women, who has studied the history of shoemaking from its beginning, and who is known as "the Edison of the shoe industry."

"I have no doubt," says Mr. De Ridder, basing his conclusions on the results of these studies, "that if we were to clamp our hands in the same way that our feet have been cramped for generations, they, too, would develop bunions and broken down muscles."

Thirty five years ago, when De Ridder began as an apprentice in one of the largest shoe factories in Rochester, N. Y., he evidenced a bump of curiosity and a genius for hard work that soon resulted in the development of many important new features in footwear. From the start, although shoemaking machinery had been standardized to the use of a flat soled last he challenged the correctness of this standard. His studies and his innovations eventually placed him in a position of authority, and today he is vice president



Oliver E. De Ridder

and general manager of the factory in which he learned his trade.

To avoid now some of the serious foot troubles that Mr. De Ridder hopes his new system of manufacture will ultimately correct, experts say that you should insist more strenuously than most people do on correctly fitting shoes; that you must avoid especially shoes that are too short, that you must not lace your shoes too tightly; and that you should give your feet variety, changing frequently from one pair of shoes to another, and to comfortable slippers at home.

Fitting Shoeleather to the Normal Foot



Above: How contours of thousands of feet were measured in perfecting the revolutionary new shoe lasts. The small circles mark the three main weight-bearing points of the foot while the lines trace four important lateral and longitudinal arches whose delicate structure is abused by badly fitting shoes.

Below: Three main weight-bearing points in the inner sole of the De Ridder shoe receive natural support at the three weight-bearing points of the foot: the heel, outer ball, and inner ball.

are, every one of them, operated read inner sole.

result of this method of compression is to fit a beautifully curved foot against a flat board as sensibly as the custom of fitting a flat board to an Indian baby's head, says the Inventor. "It has no justification from the standpoint of the anatomy of the man foot, which has three weight-bearing points, and four important lateral and longitudinal arches. Open and close your hand, and you will see the joints move from one position to another. There is a similar motion of the joints of the feet in walking. Indeed, the most beautiful mechanical devices and engineering structures are found in the foot, yet with the exception of the last now used we force these joints down upon a flat surface and depress the arches. The flat-bottom last is an anachronism, probably responsible for 90 per cent of the troubles which wearers of modern shoes experience."

The extent of these troubles is made apparent by the army's wartime experience. When the draft took able-bodied men of all classes to army training camps, an official inspection revealed that as many as 281 men of every thousand from the northwestern states and California were afflicted with



Shoe Evolution—Quaint Types of Other Days

None of the quaint shoes shown above, beginning with the light sandal of the ancient Greeks, was so injurious to the foot as some tight modern shoes, when incorrectly fitted. According to Mr. De Ridder the evolution of the shoe has resulted, not in progress, but in a standardized product less hygienic than what our ancestors wore.

flat foot, while among men from the rest of the country outside of the South the ratio ranged from 80 to 144 in every thousand. On the other hand, among men from seven Southern states, the ratio was only from 41 to 79 a thousand. The astonishing comparative freedom from foot defects of Southern army recruits was attributed by medical experts to the more common practice in Southern rural regions of going barefoot during early years of life—apparently strong testimony to the evil effects of modern shoes.

The draft figures further revealed that from 70 to 94 per cent of all enlisted men wore shoes that were from one half to 3½ sizes too short! In fact, next to the stomach, physicians declare that the feet are the most abused part of the human anatomy, and the foregoing figures show that men are as guilty as women in this disregard of sensible hygiene.

Recent recognition of the serious consequences to general health from foot troubles has resulted in a national campaign for better-fitting shoes, launched in Chi-

The mold in the tread of this new shoe may be compared with the impression left by your bare foot in the pliable, moist sand at the seashore. The inner sole is molded by steel dies, under high pressure, to these contours of the foot, and the shoe is built on a last thus molded.

The great advantage claimed for shoes built upon the new dies and lasts is that the depressions in the sole that receive the weight-bearing points of the foot, the inner and outer ball on



The Old Way and the New In Shoemaking

Above, at right: A typical flat-soled last. Contrast its shape with the natural foot, shown at right. Below, the De Ridder last, dotted lines indicating how its bulges correspond to the weight-bearing points of the foot.



ago, Ill., by medical authorities, who assert that badly fitting shoes must ultimately succumb to the same fate as tight corsets.

Now the claim is advanced on behalf of the new shoe design invented by Mr. De Ridder that a bad fit will be impossible, since the inner sole in this shoe bears certain pronounced indentations that fit precisely the weight-bearing surfaces of the soles of the normal human foot, as determined after seven years of research in the making of an uncounted number of molds and measurements.

either side of the metatarsal arch and the heel hold the foot naturally and overcome the tendency to slip backward, forward, and sideways. This tendency is ordinarily resisted by binding the foot down against a flat inner sole, a barbaric process which weakens and strains the muscles of the arches, and causes a muscular fatigue which is communicated to the entire body.

In making these shoes the molded inner soles are as-

sembled with the uppers on specially designed lasts which do not reflect the contours of the bottom of the feet, and a springy filler composition is placed between the molded inner sole and the flat outer sole. The entire sole is then rolled under pressure, so that the elastic filling fills the spaces between the inner and outer soles, the entire sole remaining comfortably tight. The contours, therefore, remain fixed, while the outer surface of the sole is like that of an ordinary shoe.

Mr. De Ridder's effort, to sum it up, has been to design a shoe that will give the same foot comfort from the start that an old shoe does, without detracting from its outward appearance.

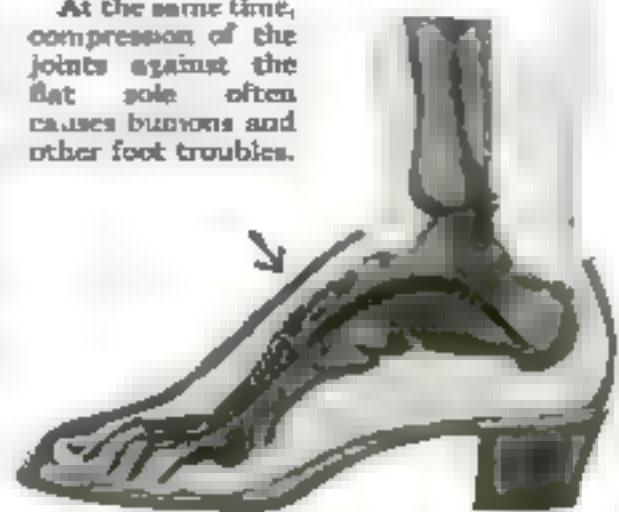
How Flat Soles and Tight Laces Ruin Our Feet

IN THE normal human foot the arch may be compared with a resilient bow, which bends under the weight of our bodies as we walk and gives the "spring" to our step.

The accompanying X-ray diagram illustrates the foot's bowlike structure and shows how, in a tightly laced, ill-fitting shoe, the joints of the foot are compressed, while pressure applied by the tight lacing in the direction of the arrow causes the arch to lose its natural, bowlike resiliency. The muscles that should pull it back into shape at each step are strained, and finally grow flabby.

Thus the arches break down, causing muscular fatigue that is communicated to the entire body.

At the same time, compression of the joints against the flat sole often causes bunions and other foot troubles.



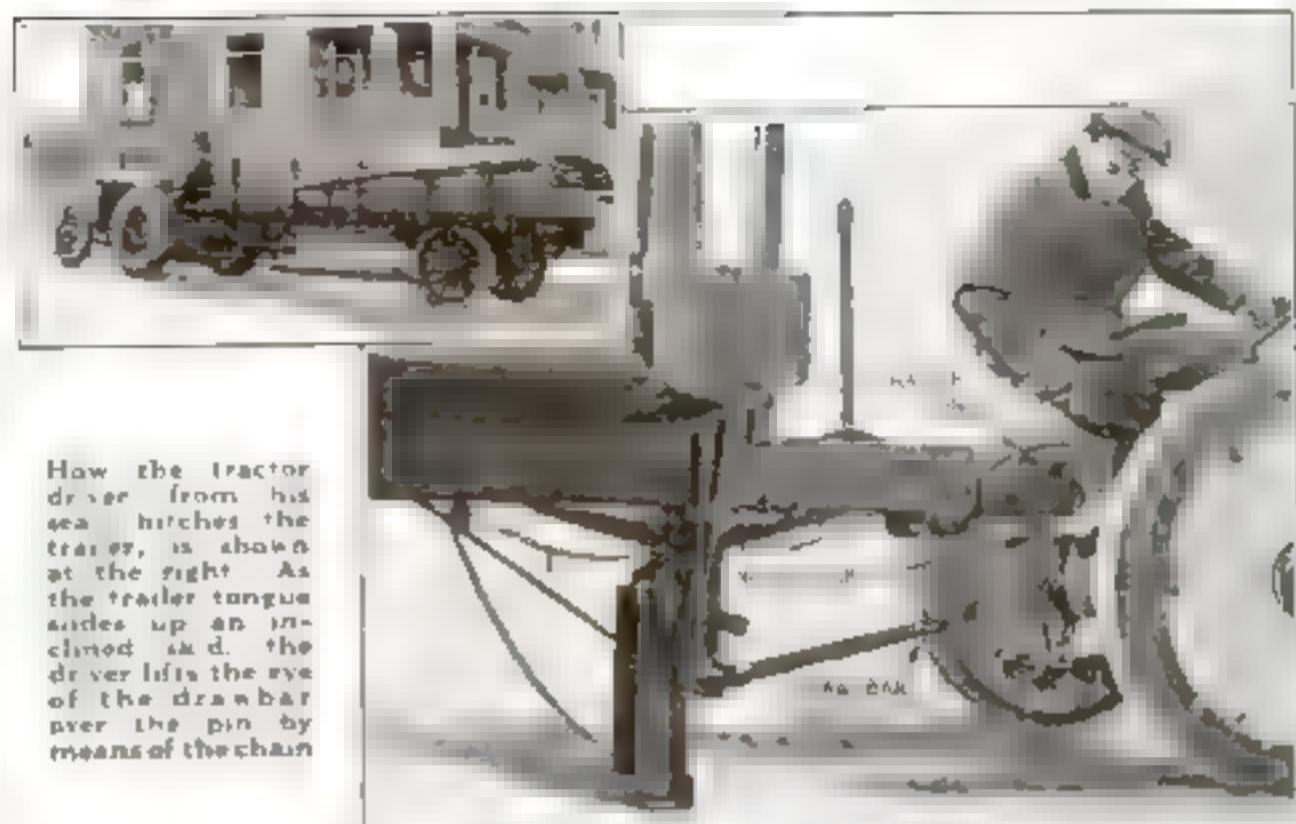
Automatic Hitch for Tractor Trailer

SPECIAL automatic hitching attachments for the tractor trailer, which transfer the dead weight of the trailer from the drawbar to the spring suspended platform of the tractor, have been incorporated in a new type of trailmobile.

By means of a long tongue that slides over the platform of the tractor, 80 per cent of the trailer load is pivoted directly over the tractor wheels where the traction is greatest.

Chain controls permit the tractor driver, from his position in the seat, to drop the trailer. First, the prop that supports the trailer when idle is lowered. Afterward a pin is pulled from the drawbar post and the eyelet of the bar lifted over the post. The tongue of the trailer slides down an inclined skid from the tractor platform.

In hitching the trailer, the driver uses the chain to guide the eye over the pin.



How the tractor driver, from his seat, hitches the trailer, is shown at the right. As the trailer tongue slides up an inclined skid, the driver lifts the eye of the drawbar over the pin by means of the chain.

Glue Pencil Replaces Paste-Pot

A GLUE pencil that leaves a dot of mucilage wherever it is pressed upon the paper is the latest invention to replace the pastepot. The device is equipped with a small ball valve at the tip, similar to the valves in some types of grease cups. This makes the pencil leakproof, since the valve closes the tip until the pencil is held vertically and pressed upon the paper.

The barrel of the pencil is filled with mucilage by slipping off the valve head, just as a bottle stopper is removed.



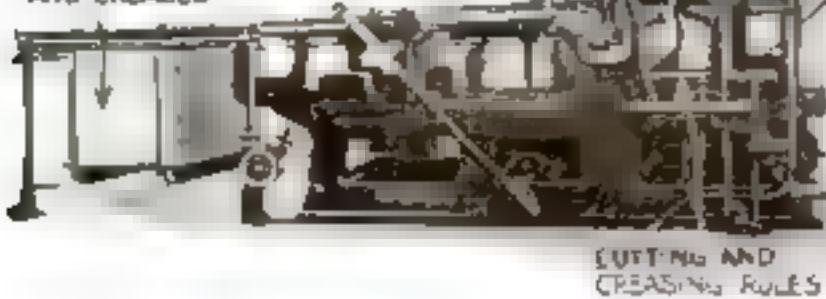
New Machine Cuts and Folds 400,000 Boxes an Hour

WITH orders for folding boxes being placed by the 100,000,000, and with one plant alone producing 3,000,000 cigarette cartons every day, even the latest development in automatic machinery for making folding boxes, capable of turning out 400,000 units an hour, has difficulty in keeping pace with the public demand for package goods.



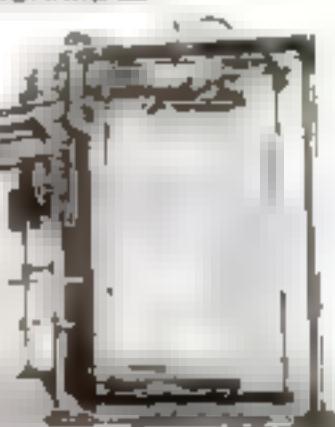
How the cardboard blanks are creased and cut

Sheets Cut and Creased



The entire process is shown below

PRINTED SHEETS FED AUTOMATICALLY



CUTTING AND CREATING RULES

In the latest cutting and folding press the cardboard for boxes is first printed or lithographed on large sized sheets, often in six colors. As many as 300 complete patterns may be laid out on a single sheet of stock, and all of these are cut out simultaneously by a manifold cutting die.

To prepare the boxes for folding, another set of knives placed in the same die scores the creases. The difference in depth of cut between a cutting and a creasing die is only 0.006 of an inch. The die maker cuts standard rules to the different lengths required for each die, and assembles them in a form as a printer assembles type, using blocks of cherry wood to fill in the blank spaces.

After the cutting form, or "chase" is bolted to the flat bed of the box making machine, a cylinder that rotates just above

is prepared as a "counter die" by gluing a sheet of boxboard around the cylinder and cutting out a little strip of this paper over every creasing rule on the flat die. When the press is in operation, the creasing rules force the stock into these crevices, and make creases for folding, while the longer rules cut a little deeper and sever the stock into blanks for the boxes. The average speed of a press is 1500 full size sheets an hour.

The separate blanks are then fed automatically into a gluing machine, through which they pass at high speed. Here the inside edges of each blank are given a coat of hot glue, then steel rollers fold the blanks along the creased lines with sufficient pressure to glue the box tightly together. The finished boxes are then tied into piles of 100 on an automatic bundling machine.

Snakes Kill Few Persons in the United States

DEATH from snake bites in the United States is comparatively rare, although the average mortality from venomous snakes is more than 10 per cent of the persons bitten, according to figures compiled by the Biological Survey of the Department of Agriculture.

The reason for this is that relatively few persons encounter or are bitten by the dangerous species. The most venomous of American snakes live in sparsely settled districts.

Whole Community Joins in Nebraska Coyote Hunt



Above: A typical community coyote hunt at Holstein, Neb., in which thousands of grownups and children, forming a 10-mile-long square, close in and trap the prairie wolves. At right: Nine of the animals bagged in the most recent hunt.

THREE thousand men, women and children, distributed over a Nebraska prairie in the form of a hollow square, 10 miles on a side, form a signal call if the first shot rings out, riding toward the center, guns drawn, traps set and the fun begins.

Rabbits, scared from their burrows, scurry hither-skitter, pursued by the patter of rifle bullets. Grouse, frightened from cornfields, fly up over the inclosing lines, some of them to be dropped by crack shots. Other small animals and birds scamper and flutter to shelter.

Thousands Participate in the Hunt

The great community coyote hunt of Holstein, Neb.—the big event of the year—is on. And it is a community affair indeed. Long before the day is set, "Are you going to the wolf hunt?" is the one important topic of conversation in Nebraska counties within traveling distance of Holstein; and when the big day comes, hundreds of farmers with their families arrive in wagons, on horseback and in automobiles.

Although coyotes, the thieving wolves of the prairies, are the main objects of the hunt, any wild creature that runs or flies is a legitimate target.

When one of the many wolves is caught between "Coyote" lines, he pauses down the line. As the men grow nervous, the hills, and canyons are rapidly combed. The captains ride up and down the lines, closing unwatched gaps through which a coyote might escape.

Yet in spite of these precautions, during the last hunt three broke through the trap to freedom. One of them, creeping over a knoll, apparently hoping to escape the advancing line, which he could see from either side, crouched low in the grass until the tread of the feet was almost on him. Then watching his chance, he picked an opening and leaped for it. The surprised hunters missed shot after shot, and the frenzied animal, travelling at a pace that probably broke the record in coyote annals, actually distanced the gun shots and made himself safe.

A flag tower in the basin of a ring of hills was the objective of the closing lines. But instead of closing up at once and despatching the corralled wolves, the hunters halted a few hundred yards away while horsemen entered in a futile but exciting attempt to

take the coyotes. One rider, failing to get the animal he was chasing, snared it with the elusive creature, and grasped it by the tail, later riding around the ring proudly displaying the snaring beast before killing it.

Finally the thousands of closely packed foot hunters impatiently broke from the lines, firing at the animals whenever a chance offered. When the closing signal was blown, a counting showed nine dead coyotes. The pelts were auctioned off and the proceeds donated to a local charity.



Fire Blasts Kill Weeds in City Parkway

FIRE-BLASTING is now being used to destroy weeds along the parkways of Alhambra, Calif. The city has equipped a wagon with a combination pressure tank,



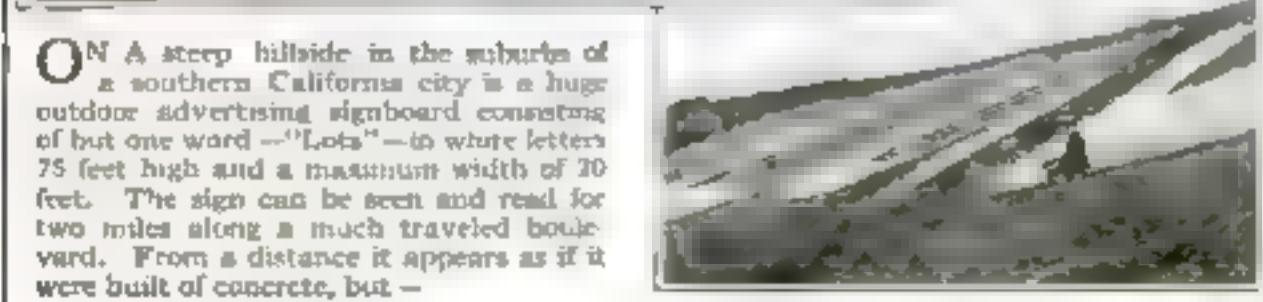
Blasts of flame from a mixture of kerosene and air, over the weeds.

Huge Hillside Sign Built of Old Boxes



CLOSE inspection reveals that the builder saved money by forming sides and ends of packing box lumber into letters and painting them.

ON A steep hillside in the suburbs of a southern California city is a huge outdoor advertising signboard consisting of but one word—"Lotto"—in white letters 75 feet high and a maximum width of 20 feet. The sign can be seen and read for two miles along a much traveled boulevard. From a distance it appears as if it were built of concrete, but—



a kerosene reservoir, and a small gasoline engine to drive a centrifugal blower.

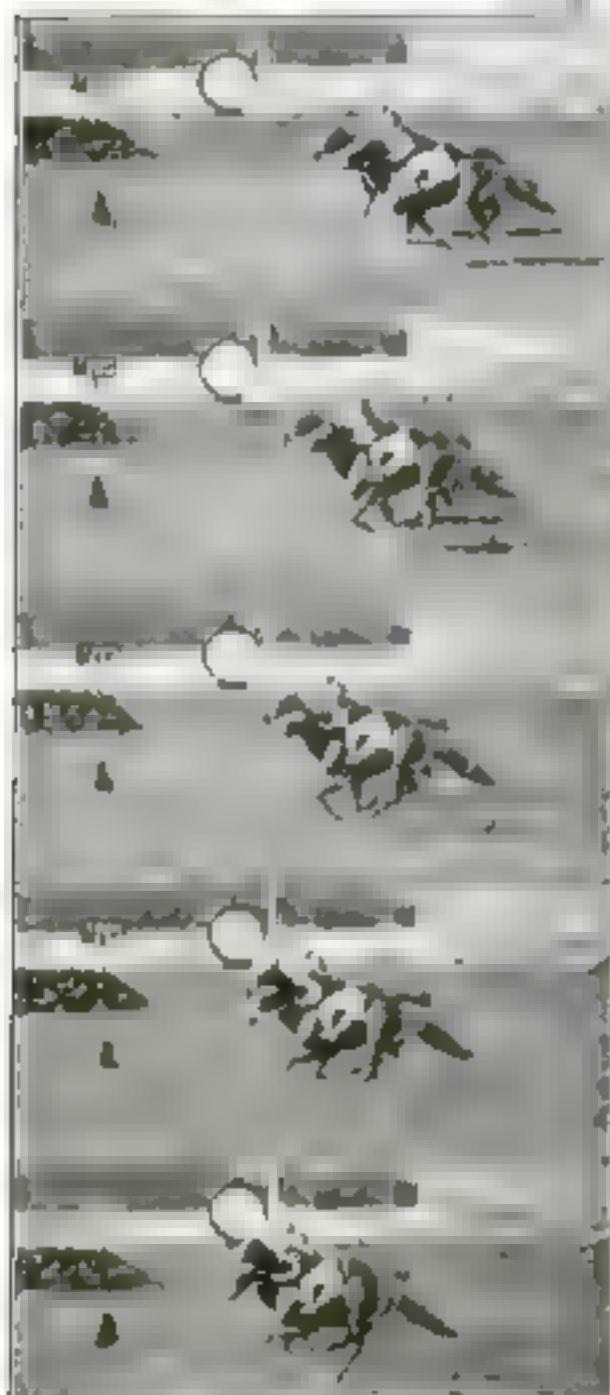
From the tanks the mixture of vaporized kerosene and compressed air is delivered through hoses ending in long metal nozzles improvised from 1½-inch pipe. The blast of flame is so hot that weeds are consumed in an instant. Two men with this apparatus can destroy as many weeds in an hour as they could dig in a day.

Camera Reveals Winning Horse when Judges Fail

HORSE races "won by a nose" are too close for the human eye to judge correctly, say experts. For this reason European race tracks are adopting a photographic method that not only pictures finally the final result but also preserves a vivid record of the thrilling progress of the leaders during the last six feet of a neck-and-neck race.

Five individual cameras are used in one box, with the lenses pointed in different directions to cover over a wide angle.

Which Is the Winner?



New X-Rays Discovered

MEASUREMENTS made in 12 different gases and vapors by the Bureau of Standards reveal X-rays having wave lengths never before known. There has always existed a dark region between the waves of visible light and those of the longest X-rays, but this gap is now nearly closed.

X-rays, light waves, and radio waves differ in their wave lengths. Radio waves are the longest, then follow light waves, which vary from the red end of the spectrum to the violet, and lastly the X-rays, the longest waves of which have been found to be only one billionth of a millimeter in length, a millimeter being about one twenty-fifth of an inch.



SEE ACCURATELY THAN COULD ANY HUMAN EYE. Shown above, the black boxes halfway up the judges' stand each containing a five lens camera of the type illustrated in the inset. Note in picture at left, that the second horse passed the winner an

inch or two. Near the track open the camera shutters progressively. The result is progressive pictures showing the exact position of each horse at the moment of the finish. An ultra rapid shutter speed may be required for the work, as the horses run over a wide angle.

The plates are specially selected for their extreme sensitivity. With the combination of fast lens and plate a shutter speed of 1/1000 of a second is necessary.

An idea of the rapidity demanded in the lenses is easily understood from the fact that the distance covered by each galloping horse between one picture and the next is approximately 40 centimeters, or about

18 inches. The five pictures taken together represent a distance covered of slightly over six feet six inches.

of use as a basis of comparison it is essential that the plates be developed within a short time after the finish of the race. Appropriately arranged accomplish this. In practice it was found possible to have the five plates developed and enlarged to a 16 by 20 sheet within eight minutes after the horses had crossed the finishing line.

Chain Screens Protect from Furnace Heat

PATENTED protection against heat made of many small chains hung vertically from the top of the furnace door hold back the intense heat of the fire. A worker can pass through the flames from striking back at the worker when the door is opened. The screen is constantly visible through the strands, yet thermometers have shown that with the screen in place 26 per cent of the glare and heat from the glowing bed of coals is held by such means within the furnace.

Where tongs must be used to insert and withdraw material from the furnace, the chains terminate in metal tubing, since chain links would catch in the jaws of the tongs. In other installations the chains are arranged on pulleys so that when the furnace door is opened, the screen drops in front of the aperture.



Numerous small chains, hung at the furnace door, hold back 26 per cent of the glare and heat.

During the recent test of the effectiveness of the chain screen, a thermometer registered a temperature of 110 degrees at a point 10 inches from the closed door. When the door was opened without a screen in place, the temperature increased to 400° F. Upon screening the door, the thermometer dropped to 135 degrees, showing a heat protection of 265 degrees.

Will New "Sugar Cane Lumber" Cut Cost of Home Building?

Great Strength in Boards of Waste Fiber

A NEW "woodless" lumber, manufactured from sugar-cane waste and remarkable for extreme lightness, strength, and excellent insulating qualities, is now being turned out by Louisiana manufacturers, who claim that their product will lower the cost of house construction, cut home fuel bills in half, and, when made into shipping containers, save hundreds of thousands of dollars annually in freight bills.

"Cane Boards" 900 Feet Long

One of the unique characteristics of this "mangle cane lumber" is the extraordinary size in which it can be manufactured, boards 12 feet wide and 900 feet long—nearly the height of the Eiffel Tower—having actually been produced in a plant recently erected in New Orleans, La.

The new lumber is made from "bagasse," which is the fiber left after the juice is pressed from the sugar cane. A yearly production of nearly 500,000 tons of bagasse was formerly burned under the boilers of the sugar refineries as the cheapest way of disposing of it; but recently a process has been discovered by which it can be converted into a lumber that will not split, and which is so light that a man can lift a board four feet wide and 12 feet high with one hand.

At right: In huge breaking machines the sugar-cane fiber is reduced to short lengths and treated with chemicals to form a cohesive building board



Ten thousand tons of bagasse at New Orleans, waiting to be manufactured into building board



This bungalow was built entirely of the new woodless lumber

The first step in the lumber-making process is to cook the fibers in huge vats to kill the spores that otherwise would cause decay. The fibers are then placed in beating machines, which separate them. Here they are treated with waterproofing chemicals and coated with a sticky substance that makes it possible to fasten them together.

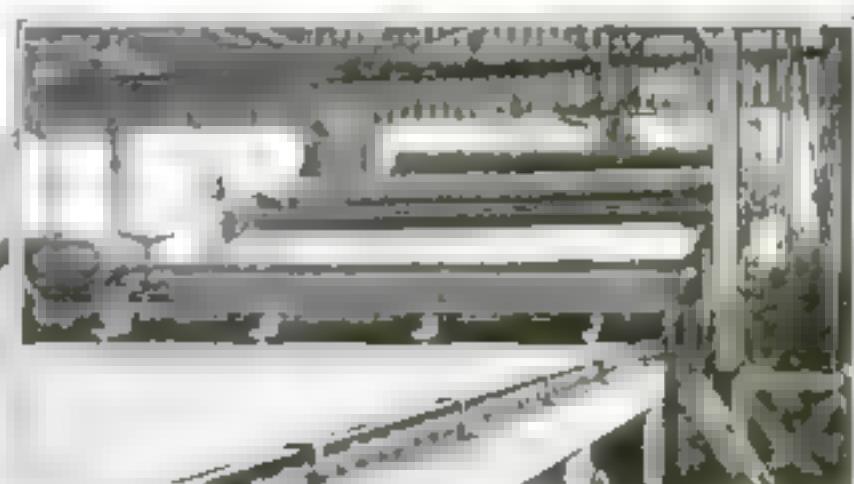
The final step in the manufacture is to compress the fibers into lumber by passing them beneath heavy steel rolls. The lumber leaves these presses in long, continuous sheets that move slowly through a 900-foot drying oven, heated to 300° F., where the water content is evaporated. This oven is said to be the largest of its kind in the world, removing 120,000 pounds of water daily. The sheets are then cut automatically by saws into standard lengths, and stacked for shipment.

Like wood, the bagasse lumber is composed chiefly of cellulose. The finished

product is extremely hard, tough, and



A 4 by 12 foot sugar-cane board that a man can lift with one hand



From beneath giant rollers that compress the sugar-cane fibers, the new lumber is cut on an endless board



Because the fibers are very long, the material cannot easily be split by driven nails. The felting and compacting process fills the structure with tiny air cells that make it light and impervious to heat.

The new lumber is being used for siding on houses and for making packing boxes. Since quarter-inch bagasse boarding material weighs only a quarter of a pound to the square foot, its use results in a great saving in freight charges. For example, one company that formerly shipped 100-pound packages of merchandise in wooden containers weighing 20 pounds, now ships the same merchandise in bagasse weighing only 8½ pounds. For a distant shipment in earload lots, this company announces a saving of \$1400 a car.

Because of its insulating quality, the new lumber in the form of boxes is said to hold merchandise at the packing-room temperature for three days when shipped in the ordinary freight cars. This quality often

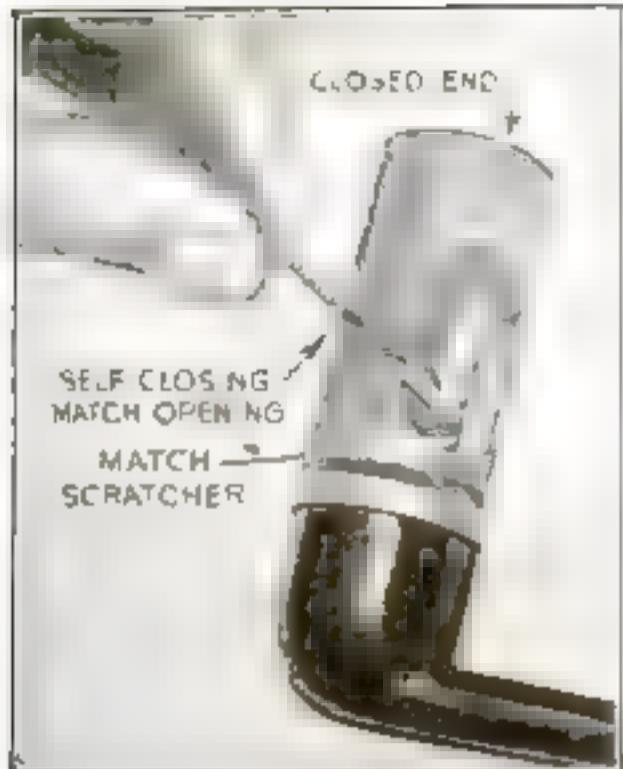
reduces the need of refrigeration.

That bagasse lumber is stronger than wood for house construction is shown in one test, steering was covered with bagasse lumber and ordinary wood sheathing. After a strain of 1200 pounds was applied to the end of the side of a frame house, the wood was nailed on in the usual way, and the lower end of the frame was clamped to the base of a testing machine, while an upward pull was applied to the top plate. In the bagasse lumber, there was a movement of only 0.04 inch at a pull of 1200 pounds, and 0.42 inch at 2600 pounds, while the wood sheathing of three-quarter-inch boards six inches wide was moved 2.14 inches at 1200 pounds.

As a Substitute for Wood

Bagasse lumber is said to be fire resistant and to take paint, plaster, calcimine or stucco without treatment. One ton of bagasse will make 3000 board feet of lumber. The makers estimate that the waste from the Louisiana canefields alone could produce a billion and a half board feet of "lumber" annually. The best grades of this "woodless" ceiling and weatherboarding lumber recently sold at \$38 a thousand square feet, as compared with a price of from \$50 to \$60 an ordinary ceiling

Traveling Crane Cleans Water Intake



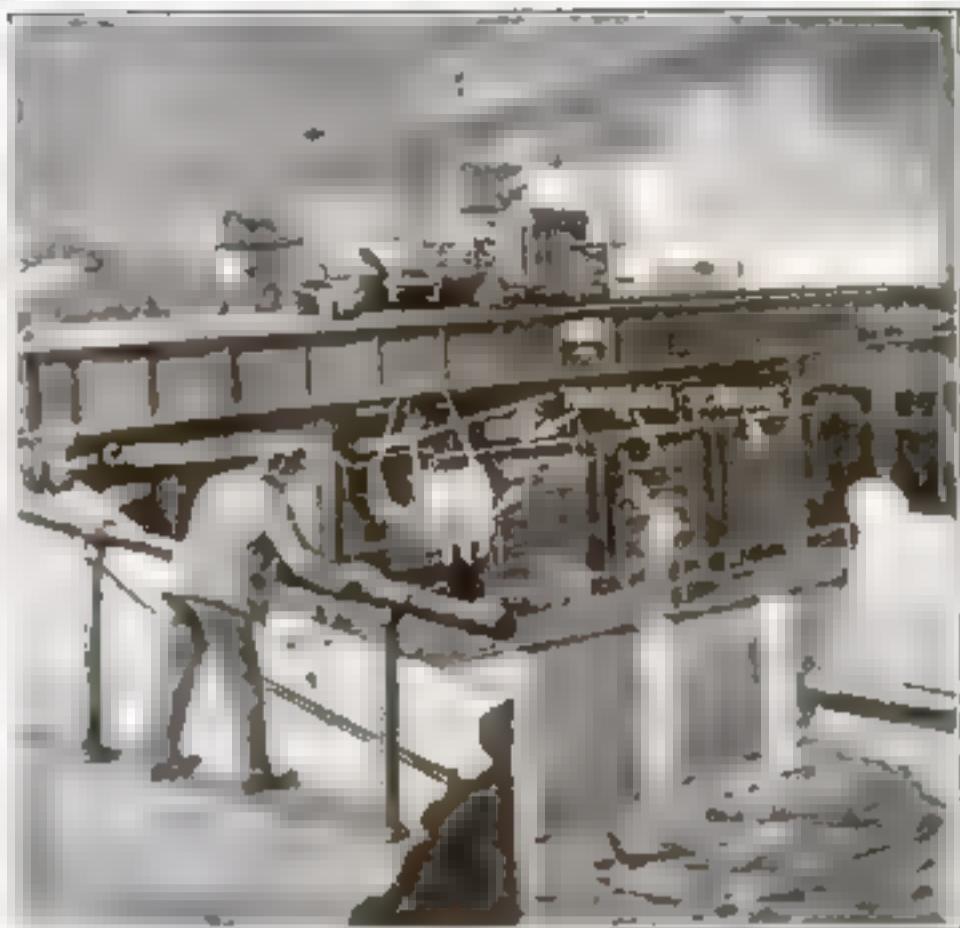
Smoking on Air Liners Is Safe with Pipe Cap

PIPE smoking on air liners is made safe by a novel pipe cap and lighter recently introduced in England. It consists of a cylinder of metal gauze closed at one end and terminating at the other in an attachment to the pipe bowl.

The match is inserted through a self-closing aperture in the gauze and ignited by striking the head on a strip of abrasive material inside. The gauze allows air currents to pass inward and the smoke outward, but the flame within can never ignite gasoline vapor on the outside, since the fine wires quickly lower the temperature of the flame below the gas ignition point.

THE use of a traveling electric crane to clear silt and debris from the water intake of a power plant is a new departure in engineering. In the installation at Cincinnati, Ohio, large debris is arrested by heavy iron grillwork backed by traveling screens, while a grab bucket from the crane removes both the silt from the well and the driftwood from the front of the hurdle or grill. The grab bucket is often called on to handle heavy material. Frequently it brings up large water-logged timbers, and on one occasion a cow drowned in an upriver flood some weeks before.

The intake well is shaped like a sector of a circle, and the crane spans it radially. One end of the crane pivots and the other travels on an arc-shaped track at the outside edge of the well. The crane trolley with its suspended bucket travels along the entire length of the crane, and is con-



As the pivoted crane sweeps along the arc-shaped well, a grab bucket removes debris arrested by grillwork.

trolled by an operator, who is guided in his action by peering down between the I-beams from which the bucket is suspended.

The extreme span is 80 feet, and the total lift of the bucket 100 feet. Two 7½-horsepower motors operate the trolley, and two 45-horsepower motors the bucket. All four of the motors are equipped with electric brakes.

Engine Runs Homemade Coal Conveyor



Coal passes through a chute at the bottom of the truck to the conveyor, which carries it to another chute leading into the cellar.

TO DELIVER coal to customers living in houses 50 or more feet from the nearest driveway, without injuring the lawns, shrubs, and flower beds surrounding the dwelling, an ingenious coal dealer in Geneca Falls, N. Y., has built for himself a portable conveyor out of odds and ends picked up about his coal yard.

The conveyor, driven by a 1½-horsepower gasoline engine, is mounted on two wheels and is long enough to bridge a lawn from 30 to 50 feet wide. The coal is delivered to the conveyor by a short gravity chute from the bottom of the coal truck and is carried to the top of the conveyor trestle, where it is dumped into the chute that delivers the coal through a window to the bin in the cellar.

After the gasoline engine of the conveyor has been started and the trapdoor of the truck opened, the coal automatically begins its journey to the coalbin without any manual assistance. Two tons of coal

can be delivered by this conveyor in not more than six minutes.

Sunlight Cure for Rickets

THAT rickets, a common disease among children, is caused by lack of sunlight rather than by lack of vitamins, as has been supposed, is the conclusion reached after experiments with sunlight at the College of Physicians and Surgeons, Columbia University.

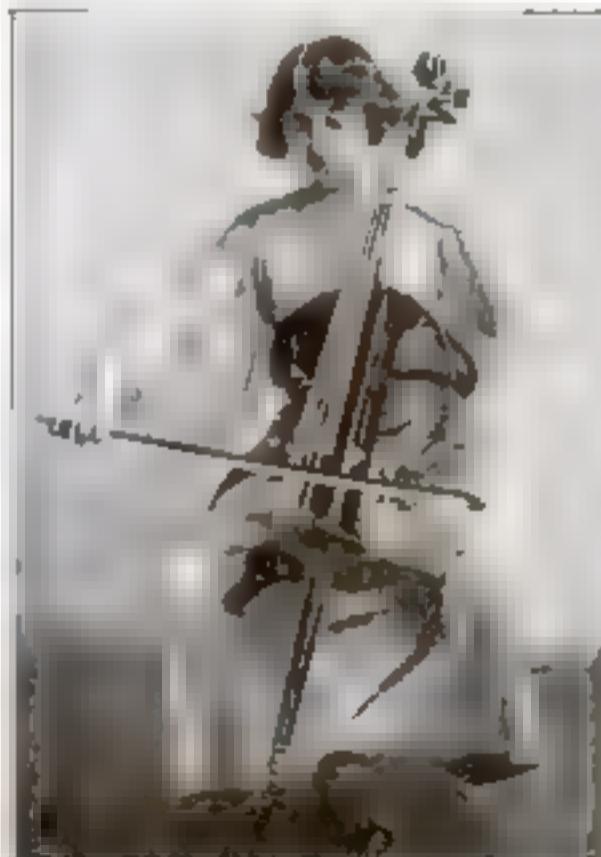
Tests with animals revealed that the disease was contracted almost without exception by those kept in darkness, while other animals on the same diet, but exposed regularly to sunlight, showed no signs of the disease.

Ultra violet rays of the sun, passing through the skin, are believed to act powerfully on the blood, effecting what is usually a permanent cure.

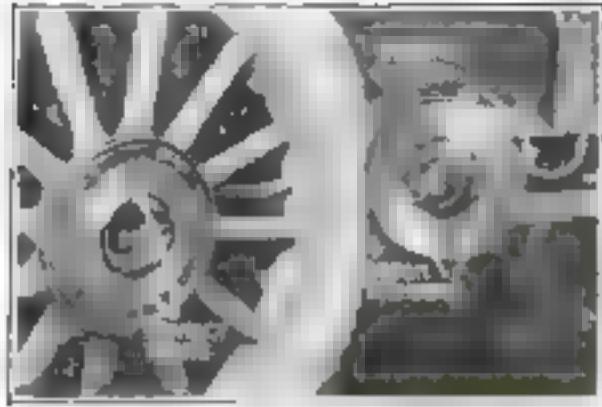
Silent Practice 'Cello Is Collapsible

REALIZING that the long hours of practice on her 'cello sometimes bothered occupants of adjacent rooms, Mlle. Adele Clément, an honor pupil of the Paris Conservatoire, has invented a semi-mute 'cello which is collapsible.

Without sounding board and sound chamber, the 'cello cannot be heard outside the room in which it is played.



Practising on the silent 'cello



Counter on Auto Wheel Measures Distances

GREATER speed in road measurements, such as are required in staking out telephone poles, has been obtained by the invention of an electric device, attached to the automobile wheel, that accurately records distances.

The counter is mounted on the instrument board, and is operated by an electric interrupter on the front wheel, which consists of two small stationary brushes in contact with a revolving surface fixed to the wheel. Insulated segments set in the part attached to the wheel interrupt the circuit through a counter magnet as they pass over the brushes. The interrupter is arranged to count half revolutions of the wheel, each count representing about four feet.

The above photograph shows the wheel lifted from the axle, revealing contact points.

Truck Body Dumps Bricks in Neat Pile

A SPECIAL truck body recently developed for handling bricks will dump an entire load in a neat pile containing from 1,000 to 2,000 bricks.



without breakage. Only one man is needed to operate the truck and body.

In loading the special body, a wooden platform or pallet is inserted in brackets at the rear of the body. The bricks are then piled against the pallet. When it is desired to dump the load, the power of the engine is geared through to a mechanism that tips the body backward to a vertical position. This motion deposits the bricks on the pallet so that when the truck is driven forward the rear of the body slides from under the pallet, leaving the bricks piled on it.

The body is demountable and may be set on or off the truck by using the power of the engine. One body can be left at the yard for loading while another is on the truck making a delivery.

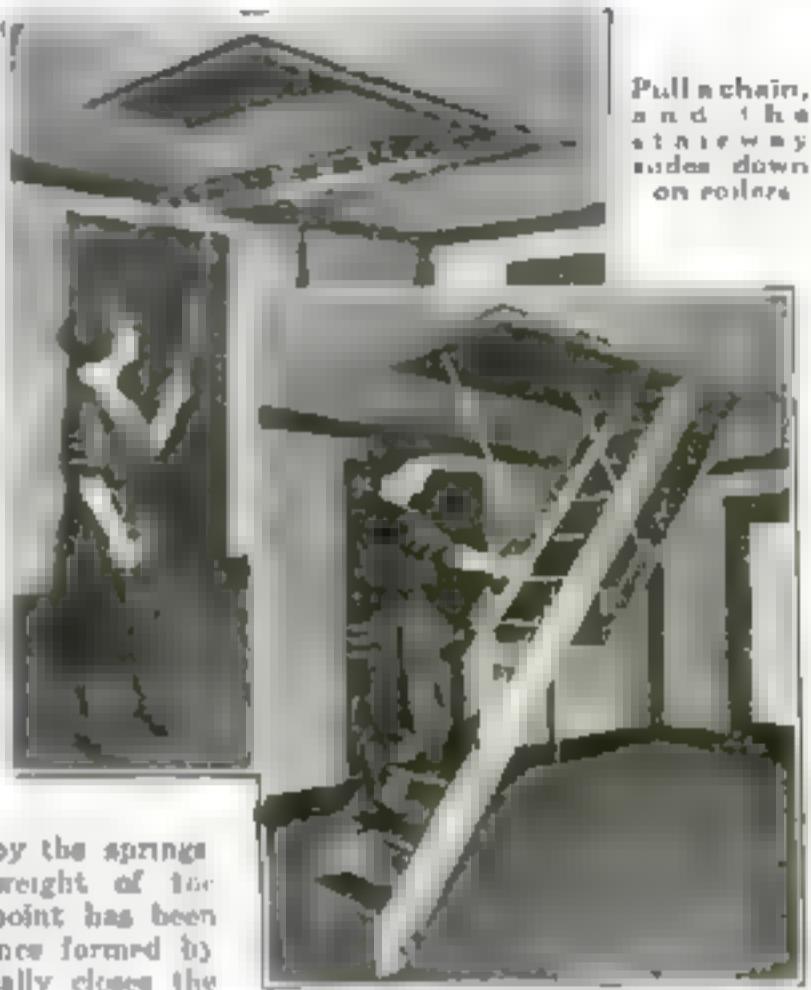
The frame of the dumping device is

Movable Stairway Vanishes into Ceiling

PORTABLE stairways that slide into the room above have been developed for use in bungalows where space must be conserved and in houses where space is not available for permanent steps. A panel-covered opening about the size of an ordinary door accommodates the passage of the stairway through the ceiling.

The stairway slides on rollers supported by the hinged ceiling door. When it is desired to use the steps, a slight pull on a chain lowers the panel and the stairs slide downward. A catch at the top holds them securely.

To raise the stairs the housewife slides them up on the panel, aided by the springs partly supporting the weight of the stairs. After a certain point has been reached, the counterbalance formed by the upper end automatically closes the panel door into the ceiling.



Pull a chain, and the stairway slides down on rollers

Air Raid "Listeners" as Radio Amplifiers

LA RGE horns that were used in England during the war to listen for the approach of German air raiders are being converted into radio horns for the entertainment of the public.

Instead of receiving sounds from the air and intensifying them by reflecting them upon a microphone placed at the tip of the cone, as they did during the war, these horns now act as megaphones for the broadcast distribution of sound waves reproduced in amplified intensity by the diaphragm at the small end, operated by the impulses of the radio waves.

The set shown below was recently used at a military exhibition at Tolworth, England, to amplify radiotelephone messages sent from airplanes.



bolted to the chassis of the truck and the hoist is set on a 12-inch channel. The cradle is pivoted on a rear dumping shaft in such a manner that when pulled back on the truck, the front end can be hoisted. The body slides along the truck on two large rollers, while two small rollers on the rear dumping shaft support the cradle.

Holding Cradle in Place

Projecting arms with hooks on the cradle engage a cross pipe on top of the body to hold it in place when the body is picked up or pulled from a pile of brick.

The hoist requires from three to five horsepower and is connected with the power take-off of the truck by a sprocket and chain.

Once used to detect air raiders, these horns are now radio amplifiers

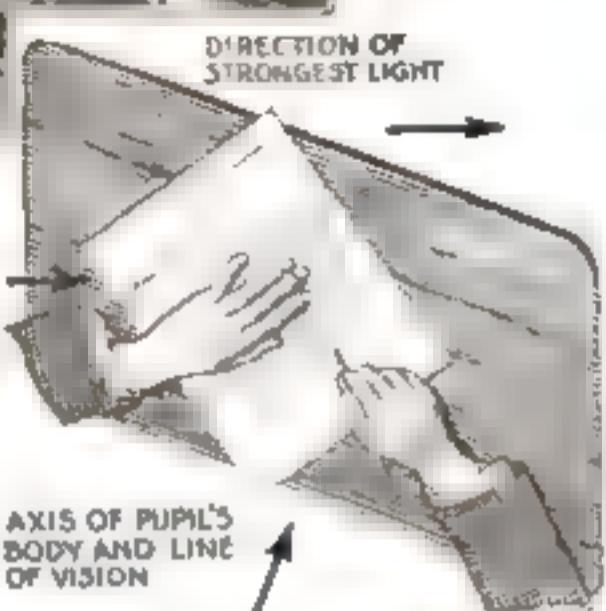
Desks "Out-of-Square" Help Pupils' Eyes



TO SOLVE the problem of comfortably seating school pupils with their backs to the windows and their faces toward the teacher, and so eliminate eye strain, strangely shaped desks are now being manufactured, the tops of which are in the form of "rhomboids," or figures that may be described as "distorted rectangles," having opposite sides and angles equal, but not being equilateral. These desks are now in use in classrooms in Modesto, Calif.

In the usual modern schoolroom, windows occupy nearly 70 per cent of the wall area, and with the rectangular arrangement of seats, nearly three quarters of the pupils' work is done in direct and reflected sunlight, crossing the line of vision at an acute angle.

To lessen this angle the inventor has placed each desk and seat at an angle of



22½ degrees to the aisle. In order to keep the side edges of each desk parallel to the aisles, the top of the desk is shaped in the form of a rhomboid. The light from the windows passes over the left shoulder, and the position of the pupil is such that his line of vision is brought close to the line of light.

With desks at an angle to aisles, the light passes over the rhomboid desk, as shown below

Twin-Seat Motorcycle Runs on Two Wheels

A MOTORCYCLE for two, with seats side by side and minus the sidecar requiring support by a third wheel, has been developed by a French inventor.

The frame of the machine supports between the wheels a cross frame providing a seat on each side and a double footrest large enough to hold small baggage. A double fork in front is turned by handlebars on each side of the machine.

The inventor claims that even a considerable difference in the weights of the two riders will not materially affect the balance of the machine and its vertical position.



How two ride side by side on two wheels

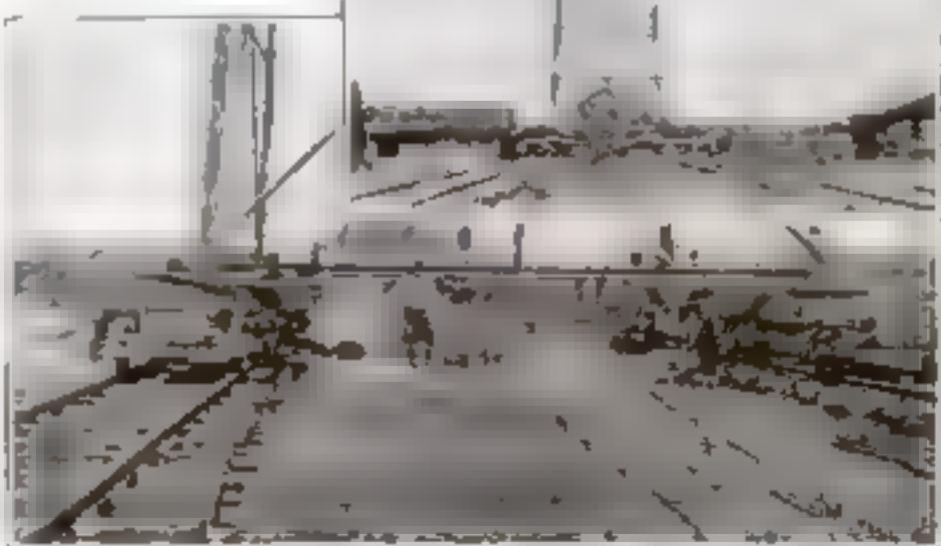
200-Foot Radio Tower Moved on Railway

BY THE ingenious use of two pairs of railway tracks, four street-car trucks and screwjacks, soldiers at Fort Sam Houston, Tex., recently lifted a steel radio tower from its foundation, transported it in an upright position to a site, set it in astant and placed it on a new foundation all within 10 days.

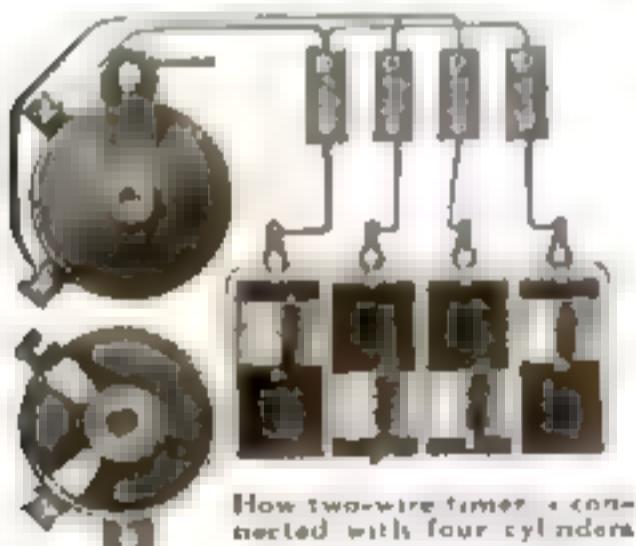
The feat was especially remarkable for the fact that the tower weighs 35 tons and 200 feet high, and rests on a base one feet square. The new location is nearly seven feet higher than was the original foundation.

Two parallel tracks were laid from the tower to its new location and on each track two street-car trucks were placed. The tower was guyed to dead men and the guy ropes were slowly paid out as the tower was lifted from its foundation by four screwjacks.

On each one of the four trucks, coupled in pairs, one of the supporting legs of the tower was placed. Then the trucks with their load were pulled by chain tackle up the slight incline to the new location. Lifting the tower off the trucks and depositing it safely upon the new foundation was accomplished by screwjacks.



Screwjacks raised the four legs of the radio tower to four trucks, which were hauled by chain tackle



How two-wire timer is connected with four cylinders

Two-Wire Ford Timer Needs No Lubrication

IN A newly invented timer for Ford cars, which uses two wires instead of the usual four, sliding brushes and contact surfaces are of copper and brass, eliminating need of lubrication and insuring an excellent electrical contact of low resistance. The case of the timer is molded of composition material.

Fouling of the timer wires by the fan belt is prevented by locating the two lead wires from the timer on the side opposite the belt.

THE Editor will be glad to supply, wherever possible, the names and addresses of manufacturers of devices mentioned in this magazine.

Trade-Pulling Window Displays World Products



A WINDOW trimming idea that not only attracted a continual gathering of pedestrians in Boston, Mass., but brought many requests from school teachers for photographs of the display, consisted merely of a huge map of the world with ribbons connecting the various countries with samples of the food products obtained from each country.

The map, like a back drop of a theater, filled the entire rear wall of the show window. Two panels at the sides carried

the flags of all the nations. Ribbons attached to the map with thumbtacks led down to the items imported by the grocery firm in whose window the exhibit was placed.

The map showed coffee from Brazil and Arabia, tea from China and Japan, India, and Ceylon, and oatmeal from Ireland and Scotland. Several ribbons led from Canada to packages of tobacco and containers of cheese. Spain contributed almonds, olive oil, and sweet red peppers; and San Do-

mingo sent lime juice and pickled limes. Practically every item known to a household was present in the display and properly tagged to its source.

To add to the interest, a pile of letters carrying strange appearing stamps from all nations were scattered in the foreground of the window.

This unique educational window display is not limited to the grocer, but could be made fully as interesting by the druggist, candy store or dry goods merchant.

Shaft of New Propeller Is above Water



Speed equal to that produced by twin screw propellers with 41 per cent less shaft horsepower is claimed for the new vanes

WHAT is known as propelling shallows has been lessened recently by a Scottish firm of ship-builders through the perfection of a method of driving such craft through shallow waters by means of "vane wheels," that are only partly submerged.

The vane wheel consists of a hub, to which are attached three radial vanes, similar in form to the blades of a ventilator. The vanes have a decided pitch and, striking the water at an angle when in motion, exert a forward thrust on the ship when rotating in one direction and a backward pull when rotating in the other. Each vane is riveted to two arms that form an integral part of the hub.

Two of these wheels are placed either side by side at the stern of the ship, or separately, at a slight angle, one at each

side of the craft, near the stern. They have identical dimensions and are rotated with the same speed, but in opposite directions, so as to balance the unavoidable side push exerted by the rotating blades.

Tests made with this new method of propulsion revealed that the vane wheels gave the same speed as twin screw propellers with 41 per cent less shaft horsepower. This is principally due to the fact that the wheels are only partly immersed, while the shafts and hubs are above water, and therefore exert no resistance by friction. The vane wheels also have the advantage of great maneuvering power; they turn the ship around its own center.

Suction Tool Cleans Full Swimming Pool

REMOVING dirt and sediment from the bottom and sides of an indoor swimming pool, without draining the water from the pool, is possible now with the perfection of a suction tool resembling a vacuum cleaner.

The cleaner is attached to a long, flexible hose, one end of which is coupled to a permanent plug in the side of the pool. The narrow suction slot of the tool is armed with a stiff brush that scrapes sediment from the borders of the tank. Suction is produced by an electric or gasoline pump.



Dirt, loosened by a stiff brush, is sucked through the cleaner

New Electrical and Mechanical Devices to Lighten Housework



Piano of the future is
the result of a
series of tests. A piano
made of metal.



Electric piano is
the result of a series of tests. A piano
made of metal.

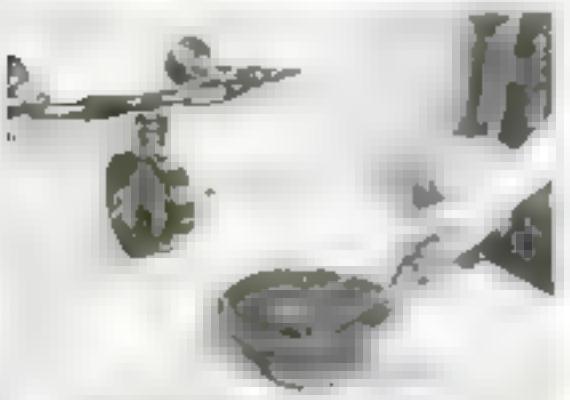


A piano of the future is
the result of a series of tests. A piano
made of metal.



Electric washing machine
uses a motor instead
of the usual hand power.
It is simple to use.

The editor will be glad to supply
wherever possible the names and
addresses of manufacturers of devices
mentioned in this and other issues of
Popular Science Monthly.



Device for
removing
dust from
carpet
uses a
motor
and
brush
to clean
carpet
as it is
dragged
over it.



This tiny bag
is designed for the
use of the housewife.
The wire
is wound around
the bag.



Shaped like a
cigarette holder
it can be used
anywhere where
there is no
electric current
or lighting out.



Breakfast can be cooked on the dining-
room table that is wired for plugging
in the electric toaster or cooker.



Armored with sharp edges of copper,
this novel glove rubs and scrapes the
skins from potatoes.



Receptacles for powder, creams, and
other beautifiers are sunk in the top of
this convenient dressing table.

Steel Fence Post Screws into the Ground

MUCH of the drudgery of fencing has been eliminated by the invention of an auger-like steel post that screws into the ground and is locked firmly in position by a vertical plate attached to the post, working equally well in hard or soft ground.

A steel lever, sharp at one end, is used first to start the post into the ground, and then is attached as a lever in turning the bit.

When the post has penetrated the ground as far as the vertical plate, a few taps start the plate into the soil and at right angles to the line of fencing. The plate is then pulled into the ground by further turning of the post.

Turned by a long lever, the auger-like fence post bores its way into the ground



Water from a high pressure pipe churns sediment in the manhole. This sediment is sucked back to the tank through a larger pipe, as shown in the diagram at the left

THE work of cleaning sewer manholes is now greatly facilitated by a recently invented transportable apparatus, consisting of a conical inclined tank, a force pump and a suction pipe, which will flush four manholes with 400 gallons of water—the amount usually required to clean one.

This saving is effected by the use of the same water again and again.

The tank is mounted at an angle of about 45 degrees on a three-ton motor chassis, which also carries a powerful pump, driven by the engine. The tank is filled with water, which is drawn out by the pump and forced through a small pipe lowered to the bottom of the manhole to be cleaned.

The force of the water issuing from the nozzle of the pipe breaks and churns the sediment at the bottom of the manhole.

The liquid mud is then drawn by suction through a large, flexible hose to the tank and deposited there. The solid parts of the mud settle to the bottom at the smaller end of the cone, while the water is used again, in a similar manner, to flush three other manholes.

From time to time the accumulation of sediment or muck is removed from the tank by opening a trapdoor at the bottom.

The force of the water above quickly removes the mud adhering to the sides of the tank.

Wheel Anchors Protect Autos in Transit

BY USING newly designed curved steel blocks to hold the wheels of automobiles while in transit, manufacturers claim to have reduced loading and unloading costs, besides practically eliminating claims for damages after the machines have reached their destination.

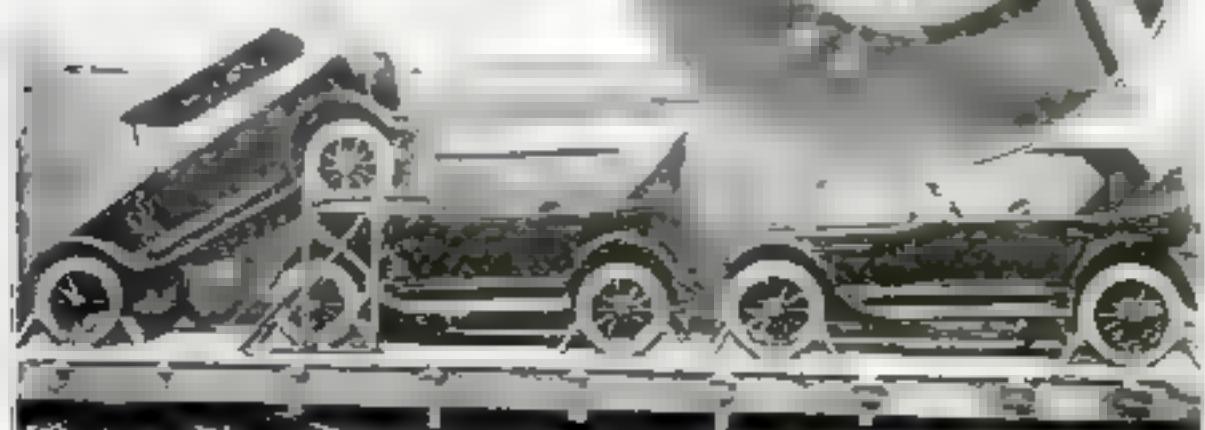
How Loading Blocks Are Built

The loading blocks are made of pressed steel and formed to the curvature of the tires. They are fastened to the freight car floor by a pin, the head of which can be removed with little damage to the flooring.

In a recent test by an auto manufacturer a carload of automobiles anchored with these blocks was driven at a speed of 25 miles an hour against a string of 15 box cars with set brakes. There was no impact that could dent the cars.

end of the first box car were demolished, but examination showed the machines had withstood the shock without a trace of damage.

The blocks are 10 $\frac{1}{2}$ inches high and weigh 10 pounds each. After the machines have been delivered, the dealer returns the set of eight blocks to the manufacturer at a cost of about 40 cents.



How automobiles are anchored to the floor of the freight car by steel blocks that fit the curvature of the tire as shown in inset

One Tank of Water Cleans Four Manholes



Shackled Cow Can't Switch Her Tail, Nor Kick

WITH troublesome extremities securely shackled by a pair of steel cuffs, recently devised, the cow can't switch her tail at milking time, nor kick over the milk bucket.

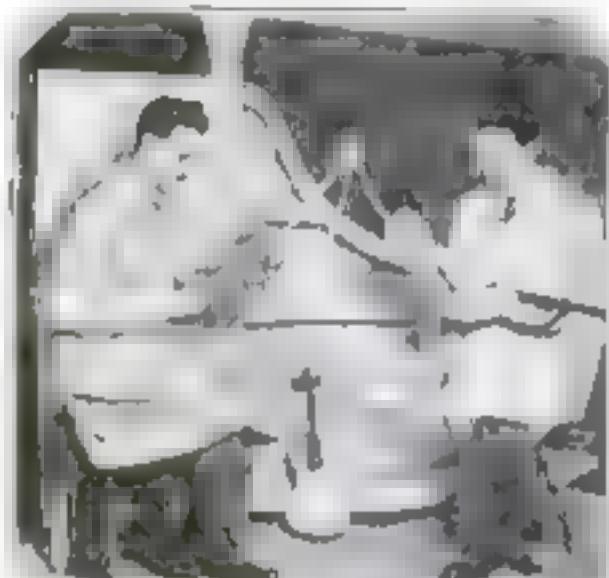
The device consists of two clamps, one of which fits tightly around the gambrel cord just above the hock of one hind leg, the other around the tail near the tassel. The two clamps are connected by a short chain.

The Editor will be glad to supply, whenever possible, the names and addresses of manufacturers of devices mentioned in this issue.

Tone Amplifier Improves Stringed Instruments

FOR the first time since the days of the great master builders of violins, an invention recently developed promises to bring a revolutionary improvement in the tonal qualities of any stringed instrument to which it is applied.

The device, which takes the place of bass bar and soundpost, consists of a long wooden strip carefully fitted and glued to the inside of the top board of the instrument, directly underneath the G string. To this strip a small sounding board is attached by two feet. This device may be attached to any stringed instrument.



Arrows point to the new sounding board, as placed under top of violin, and to piano sounding board.

material), which in turn was used as the foundation for an extension of the track. With the aid of these runways it was possible to build piles 100 feet long and 15 or more feet high.

Beacons Built on Reefs Replace Old Towers

NEW standard lighthouses, consisting of a superstructure of iron mounted on a solid concrete base that can be placed

directly over a reef or other danger spot, are now supplanting stately towers of the past—towers that, while they were picturesque, often were built miles away from the treacherous ledges they marked, and thus provided inadequate protection for shipping.

The new beacons, adopted by Uncle Sam's lighthouse service, are supplied with electric current by heavy cables from the mainland. They can be built

quickly at small expense and are easily transported to any desired location. The modern lamps are so powerful that even without lenses, they outrange the older lights with their super-red ant reflectors and lenses.

In the past, the cost of building stone or metal framework towers has been excessive. The tremendous expense of setting foundations for high towers has frequently been responsible for placing them at a distance from the danger spots.

The present tendency is to guard the coastline by a number of lights placed at frequent intervals rather than by a few powerful lamps placed far apart.

Below: the oldest lighthouse in America at Sandy Hook, N. J., built in 1804; and at right, the latest type beacon.



Blindfolded, He Assembles Typewriter in an Hour

TO DEMONSTRATE his expert skill as a typewriter mechanic, F. R. Scroggins, of San Antonio, Tex., recently sat blindfolded at a table in a show window, with a typewriter before him, and dismantled the machine completely in 11 minutes and 15 seconds. Then, still blindfolded he reassembled the machine in 56 minutes and 30 seconds.

To prove that the task wasn't difficult for him, he repeated the performance three successive times in a period of five hours.

Scroggins' remarkable feat demonstrated that repairing typewriters is one of the few professions in which the blind can find remunerative employment.

Never Too Cold to Snow

SCIENTIFICALLY speaking, it's never "too cold to snow," says S. K. Pearson, Jr., of the United States Weather Bureau.

"We all know," he tells us, "that it snows in parts of Canada and in our Northwest when the mercury registers far below zero. Our worst blizzards have either commenced with a very low temperature or terminated with the mercury near zero."

Dump Trucks Climb Piles They Build

IN THE course of a big road construction job, near Carbondale, Ill., a problem of accumulating large quantities of material in a limited space, was solved by the superintendent in charge by a novel method in which trucks, as they dumped their loads, formed their own roadway on which they climbed as the height of a pile increased.

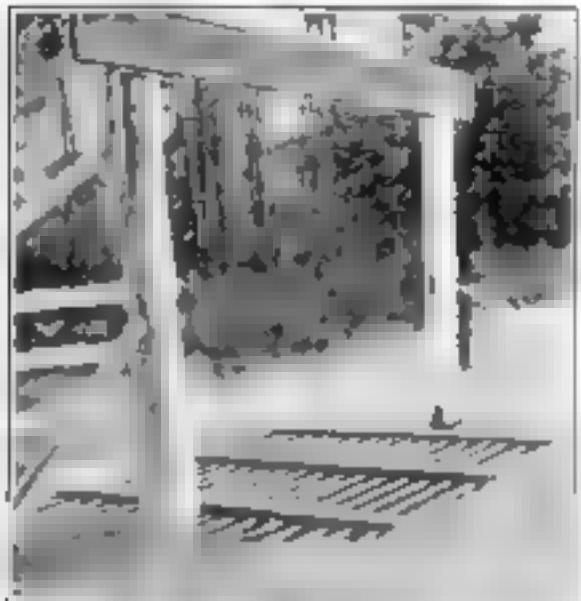
He started the pile by dumping the material from big trucks and then placed wooden tracks on top. The trucks, backing up the track, dumped more

At the right: A truck dumping its load at top of pile after climbing the ingenious wooden tracks shown above.



material, which in turn was used as the foundation for an extension of the track.

With the aid of these runways it was possible to build piles 100 feet long and 15 or more feet high.



This Farm Gate Is Always Open to Motorists

FARM gates in certain sections of Florida are like railroad cattle guards, always open for an automobile or a man on horseback, but impassable to cattle or other animals with divided hoofs. The gate is made in the form of a grating of two-by-fours, $2\frac{1}{2}$ inches apart, with the earth dug away beneath.

Autoist Opens Garage Door from His Seat

WHEN Claire Briggs, the famous cartoonist, driven up to his garage at New Rochelle, N. Y., a pull on a handy chain outside the door opens the door for him without his moving from his seat.

A chain suspended from a bracket extending 10 feet from the wall passes over a pair of pulleys to a sliding door. Very little force is needed to slide the entire door to one side, as the weight of the door is carried on rollers, and the rollers are equipped with ball bearings.

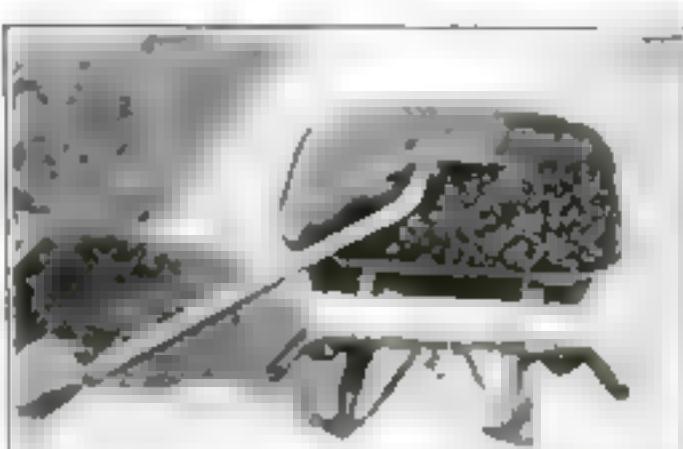


One tug on the chain, and the door slides open.

Wheelbarrow Heated for Winter Work

AMONG the most useful recent additions to the equipment of a road repairing outfit, especially during the cold season, is a gasoline-heated wheelbarrow for handling bituminous road material.

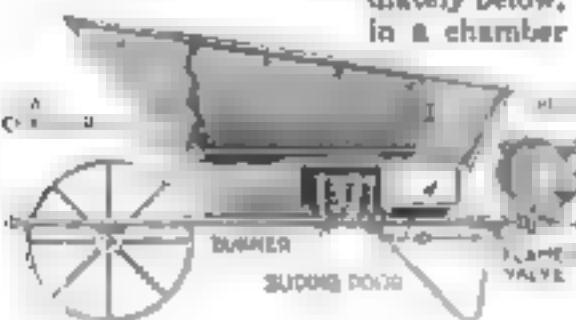
Supported on a frame of steel piping are two steel trays, one above the other. The upper tray, with a capacity of three cubic feet, holds the material to be heated and transported. Immediately below, is a chamber



The heater for this winter-time wheelbarrow is beneath the material tray and is fed by pressure pump from a tank between the handles.

the tank to the burner and is admitted to the heating coil through a needle valve that regulates the supply of gasoline and hence the heat. A small air pump attached to the gasoline tank keeps the fuel under pressure. In the outer tray, openings for admitting air and for permitting the exhaust gases to escape are provided.

Material can be dumped without interfering with the operation of the heater



formed between upper and lower trays, is a gasoline heater.

Between the handles of the barrow is a cylindrical tank that holds two gallons of gasoline, enough to heat the material in the tray for 10 hours continuously.

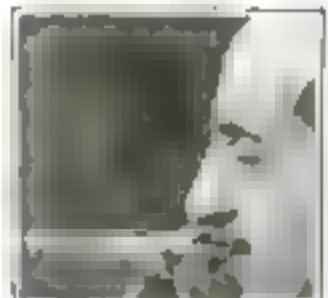
A small pipe conducts the gasoline from

WHERE is America's paper supply to come from after our pulpwood forests, now being worn out timber at the rate of 100 acres a day, have been exhausted? Read, in next month's issue, the fascinating story of "Benequen," the superabundant Mexican hemp, that is even now producing paper in commercial quantities.

Cigarette Holder also Holds Ash Tray

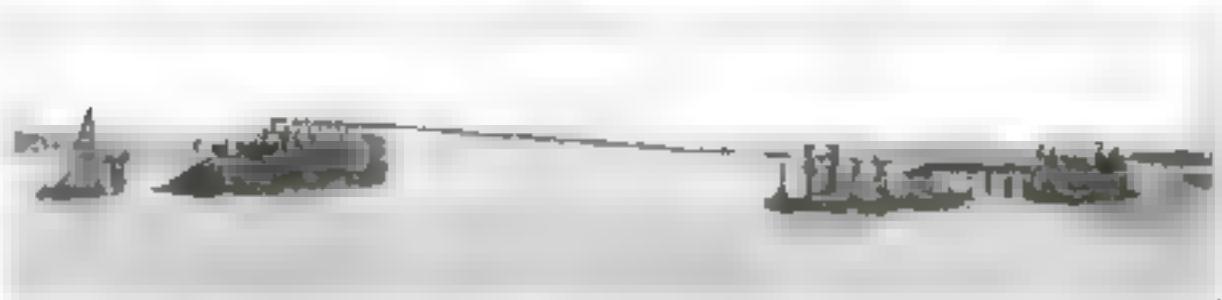
FOR the protection of rugs from the ashes that cigarette smokers are in the habit of dropping, a small aluminum attachment has been invented that may be clamped to any cigarette holder, and is so light that its weight is hardly noticeable to the person who is using it.

It is in the form of a trough, closed at one end and clamped firmly to the end of the holder.

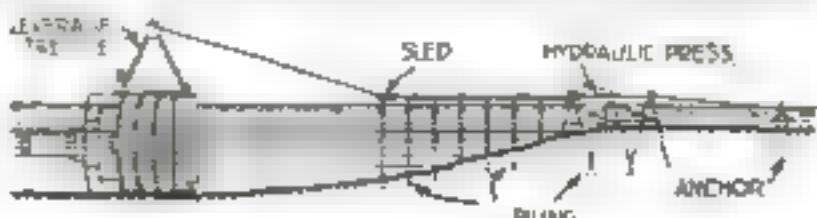


© K & H
This tray catches all cigarette ashes

How Sunken Steamer Was Floated by Cables from Shore



Pulled by hydraulic presses, cables attached to a trestle of levers fitted to the exposed side of the sunken ship, raised the vessel to an upright position.



BY MEANS of a series of hydraulic presses exerting force simultaneously through a multitude of cables, the 8000-ton German steamer, *Gneisenau*, sunk on its side in the outer harbor at Antwerp, was pulled back into upright position recently and floated to drydock.

A trestle consisting of 12 iron levers was fitted to the portion of the port side remaining above water. To these levers were attached 48 steel cables terminating at the shore end in 12 hydraulic presses having a total capacity of 3000 tons. A system of balances enables the engineers to make the 12 presses act simultaneously.

Tractor Scraper Shaves Ice for Skaters in Chicago Parks

ICE on the lakes in Chicago parks will be shaved smooth for skating this winter by a scraping machine of novel design, drawn by a small tractor. The machine, driven by a gasoline engine, is mounted on a V-shaped frame, attached to the tractor by a stiff bar bolted to the apex of the V. Each of the two arms



Mounted on a V-shaped frame and hauled by a tractor, nine motor-driven rotary cutters shave all bumps from the ice.

of the V is supported by a wheel.

The frame supports nine rotary cutters with horizontal blades that rest directly on the ice and are rotated by worm-gear transmission from the gasoline engine. It is expected that this machine will do the work heretofore done by 10 teams of horses.

New Transmission Lock Safeguards Ford

MAKING it impossible for a Ford to be started or moved under its own power, and yet permitting the car to be moved by hand in case of a fire or other emergency, a new transmission lock affords the protection against theft hitherto enjoyed only by owners of expensive cars.

The lock is screwed on in place of the original cover of the transmission case, and its keyhole plate comes just above the floor-board, where it is easily reached from the driver's seat. When the key is given a quarter turn, the teeth of a steel arm connecting with the lock project and engage with slots in the gear ring of the fly wheel. This prevents the power plant from being turned over. At the same time, a second arm on the lock turns clockwise under the edges of the transmission case opening, so that the lock cannot be unscrewed and removed.

In the unlocked position, the toothed arm is held firmly to the rear, and cannot engage the gear ring while the engine is in motion, or until the proper key is used.

The lock may be installed quickly.

First Aid Outfit Fastens to Car or Motor Boat

FIRST aid outfit containing a selected assortment of medical supplies likely to be needed by the tourist and camper, can be purchased compactly arranged in a metal cylinder that is held rigidly in a bracket screwed to any convenient part of the automobile, motor boat, or camp wall.

To the complete outfit

The aluminum tray, 8 $\frac{1}{2}$ inches in diameter and 11 $\frac{1}{4}$ inches long, contains cotton, bandages, needles, matches, caustics, plasters, and numerous other first aid requisites in addition to bottles for antiseptics and cleansing solutions. The ends of the tray are closed by two cups.



When the key is turned at least a half turn, a toothed arm engages and locks the fly wheel.

Warming Pad Heated by Chemicals



CHEMICAL action, instead of hot water or electricity, warms a heating pad of recent invention. The heat is produced by adding a small quantity of cold water, not more than one ounce, to chemicals contained in a stout canvas bag, which is enclosed in an outer bag.

The bag containing the chemicals and water is vigorously shaken and in a few moments the temperature rises to a maximum of about 200° F. If properly protected, the bag will remain hot for 24 hours.

Cattle Nose Prints, All Different, Identify Blooded Stock



Above is typical cattle nose print, obtained by pressing paper over the animal's nose.

A SYSTEM of animal identification, evolved at the University of Minnesota under the direction of William E. Peterson, has shown in actual practice that nose prints of cows, calves, and bulls are as reliable for identification purposes as finger prints of human beings. The idea was devised principally to safeguard valuable blooded cattle entered for exhibition at shows.

The method of taking the nose prints is extremely simple. After the preparation is wiped off the animal's nose with a flannel cloth, ink is applied to the nose with a stamping pad. The im-

pression is made by rolling a piece of newsprint or mimeograph paper backed by a small board over the nose of the animal, beginning at the base of the upper lip.

Careful comparison shows that no two prints of different animals were exactly alike. It is also true that the markings on the nose of an animal do not change in pattern, although they become larger with age. This method is believed to offer a positive means of identification, of particular importance in preventing substitution of pure bred stock.

Farmer-Sculptor Carves Statues from Hillside

ALTHOUGH Daniel Brice Baughman, a farmer and undertaker of Black Run, Ohio, never has had a lesson in sculpture, he has chipped for more than 20 years at the limestone that he quarries out of the high hill upon which stands his home.

Now, at the age of 45, he has laid out on the hill a memorial park, dedicated to great



With chisels forged by himself the farmer-artist carves statues in limestone.

Americans and the veterans of our wars. In this park are his statues of Washington, Lincoln, Garfield, McKinley, McPherson, Grant, Sherman, and "The Doughboy."

Baughman not only quarries his own stone, but in his own forge makes the many chisels with which he shapes the stone. He sets up the huge stones in the rough and puts on the final touches from a scaffolding. Then he paints them white, so that they stand out like marble.

Three-Inch Radio Set Has 25-Mile Range

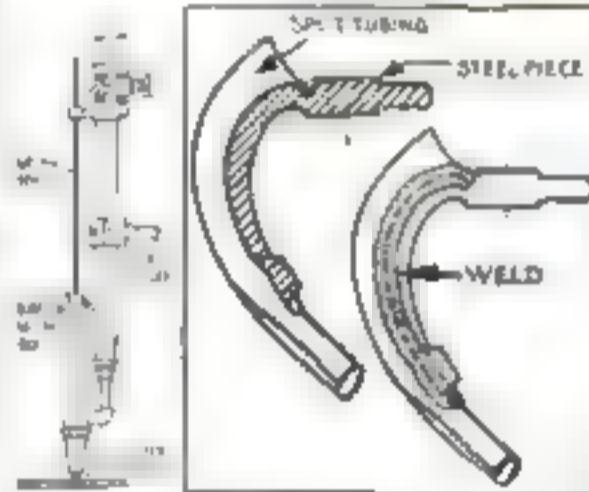
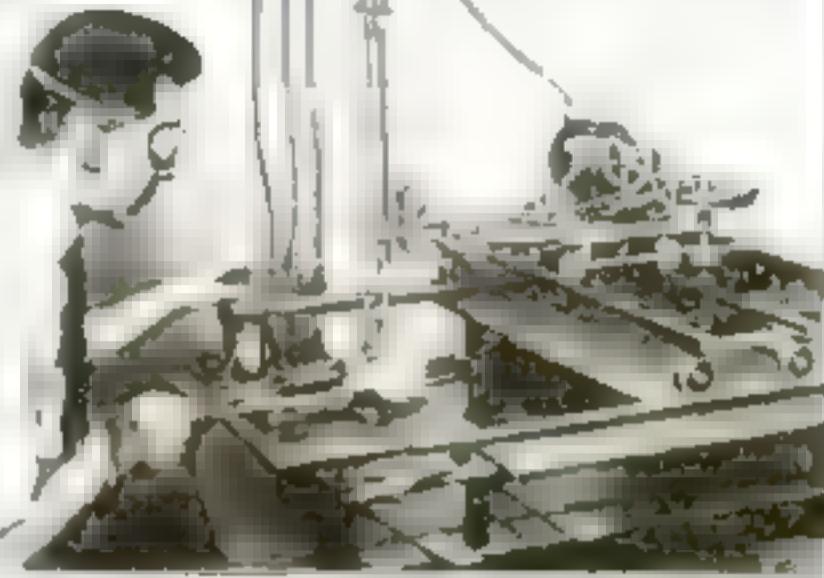


The designer, Frank L. Copeman, receiving with his compact set, shown in detail at right.

Automatic Welder "Sews" Metal Seams

WITH an ingenious welding machine recently developed, metal parts are welded together automatically in curved or straight seams, in a manner closely resembling the sewing of a seam on a sewing machine.

The welding machine has two torches—



preheating torch, which moves steadily over the center of the seam, bringing the metal nearly to the fusion point, and immediately following it a self-feeding welding torch that has a slightly circular motion. This motion causes the welding rod to oscillate from one side of the seam to the other. Both torches are fed by flexible gas tubes and both are supported by a carriage that also carries the

Above, an operator at the automatic machine, welding a drop-forged steel piece of varying thickness to a curved piece of split tubing of uniform thickness, as in diagram at left. Note that the line of welding is an irregular curve. Diagram at the extreme left shows arrangement of parts of the welder.

motor and the mechanism propelling the carriage along its track.

The track frame also rests on wheels that run on a track at right angles to the track of the carriage. This arrangement makes it possible to move the torches along any straight or curved line, in any direction, if guided by a fiber template.

Both torches are independently adjustable as to heat, height and inclination, and the progress of the carriage along its track can be controlled with accuracy by the operator. The rotary motion of the welding torch can also be regulated by changing the friction drive and the eccentric



Shield Guards Shaver of Dictating Records

TO PREVENT flying pieces of wax from dictating machine cylinders, broken while being shaved, from injuring the operator, M. G. Hoyman, of Neenah, Wis., has invented a new safety guard.

The guard is a plate glass shield that may be adjusted by means of two pivoted telescoping arms.

In three minutes' time the guard can be fastened to the bed plate of the shaving machine by removing two bolts that form a part of the machine and inserting the same bolts through the base of the guard.



How to Tune Up Your Car and Save Money

You'll Have More Power and Better All Around Performance at Less Cost if You Learn These Lessons from the Race Driver

Assuming that 10 horsepower is available at 20 miles an hour, the running gear of the untuned car absorbs seven horsepower.



IF YOUR car labors on the hills, if your engine lacks "pep" or your car lacks "kick," if your gasoline bills are too high or your tire mileage too low; if you are getting too little fun out of your car at too great cost; or if it is not as reliable a business utility as you expected:

You should hearken to the methods of the race driver, because he is a super motorist. Most of the things he does to squeeze a heartbreaking maximum speed from his fleet mount, may be applied with almost equal effectiveness to make your own car



By Harold F. Blanchard

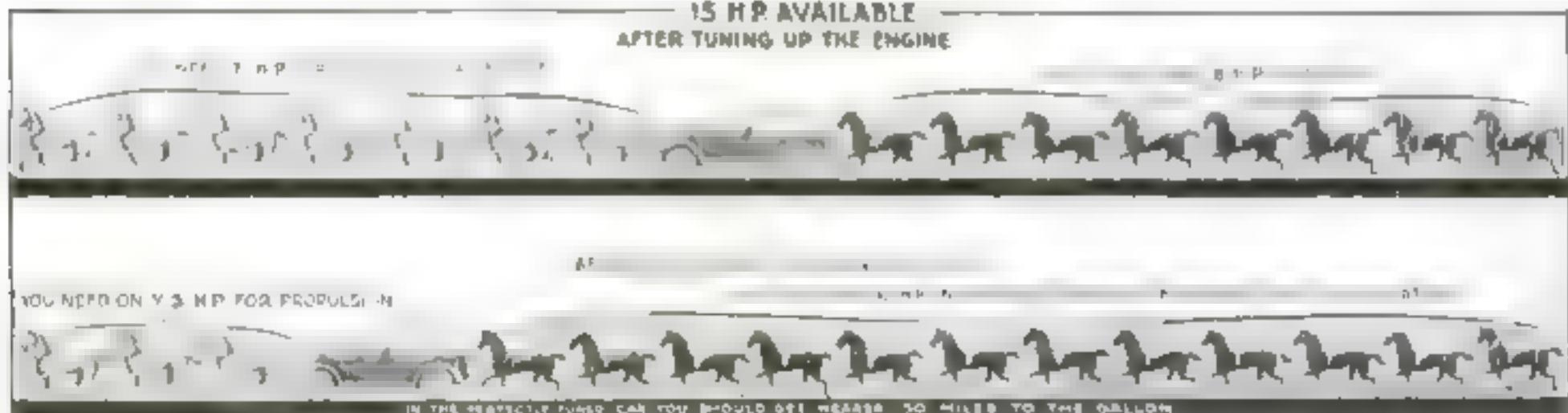
courses will not only produce the greatest speed possible, but it will give maximum hill-climbing ability, maximum economy, and maximum reliability. Incidentally, the liveliness of the car will be increased to a surprising degree.

This quality of car energy commonly called "pep," like hill-climbing and speed prowess, depends on the amount of reserve power available. If you are running 20 miles an hour, the rate at which you can

enough to require four horsepower, you must shift to second.

Now let us assume that by putting your engine into racing car condition its horsepower development at 20 miles an hour is raised to 15. With the running gear still absorbing seven horsepower, there is now eight horsepower available for acceleration or hill climbing. The reserve power has been nearly tripled by merely improving the condition of the engine.

Next, assuming that by giving careful attention to the running gear and tires, the



Tuning up the engine to develop 15 horsepower—with running gear still absorbing seven horsepower—gives you eight horsepower in reserve.

Finally—with running gear tuned up to absorb only three horsepower, your car is in perfect trim, with 12 reserve horsepower for acceleration and hill climbing.

physically fit. Tune up your car as he tunes up his and it will glide smoothly up the steepest hills; fuel, oil and repair bills will be noticeably reduced; the car will last longer and breakdowns will be almost wholly eliminated from the sum of your automobile experiences.

If a race driver, by a deft touch here and there, can increase the speed of an ordinary touring car from 45 to 75 miles an hour, there is no good reason why the average automobile owner, once he has mastered the few important secrets of power saving, cannot raise the tune of his car to that same 75-mile pitch, gaining the additional 30-mile speed that means motoring perfection, and reducing repair and maintenance costs to a minimum.

No Mystery Here

There is nothing mysterious nor difficult about the methods of the race driver. Any motorist may apply them to his own car with success without spending too much time or effort.

First, the engine must be tuned up to give its maximum power; then all friction losses in engine, chassis, and tires must be reduced to the limit. Such a

accelerate your car depends on how much reserve power is available at this speed. Suppose that at 20 miles an hour your engine develops 10 horsepower with the throttle wide open, and that of this amount the running gear, including tires, consumes seven horsepower. That leaves three horsepower for acceleration. It also means that the steepest hill you can climb on high gear is one that will absorb not more than three horsepower. If the hill is steep

power absorbed at 20 miles an hour is reduced from seven to four, the reserve horsepower is increased to 11, or nearly four times as much as was available originally.

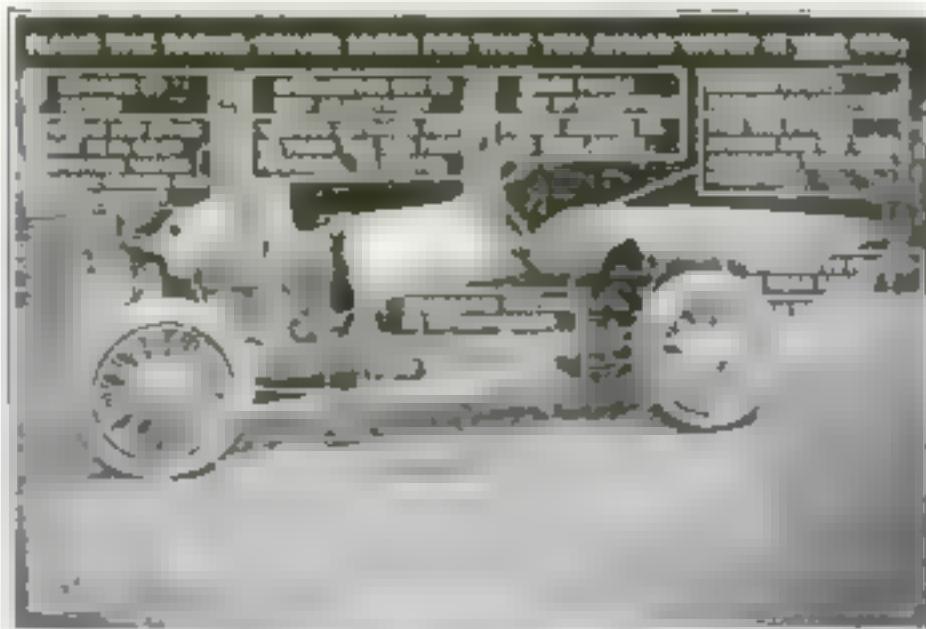
These figures are by no means exaggerations. They merely prove how much is to be gained by a sensible application of race driver methods, which I shall endeavor to describe to you in detail.

The speed of the racing car mentioned at the outset was raised first from 45 to 60 miles an hour by putting the engine in good condition, then was increased again to a 75-mile pitch by minimizing frictional losses.

First, Grind the Valves

Obviously the first step in tuning up the engine is to grind the valves and remove the carbon. Then adjust the valves, allowing .008 inch clearance for the exhaust and .004 for the intake. Any weak valve springs should be replaced.

On a racing car the spark would be timed so that with lever retarded the breaker points of the interrupter that break the spark connection would begin to separate when the piston, on the



Here are the enemies of speed and "kick" that the race driver tackles when he "tunes up" for a speed contest. Any automobile owner can profitably follow his methods.

compression stroke, is half an inch below top dead center; but the average driver will be best satisfied if the points break just as the piston reaches top center. A car with a late spark will fail to develop full power, even if the intensity is not sufficient to cause overheating. The breaker points should be smooth and should meet squarely. Their adjustment should exactly conform to the recommendations by the manufacturer.

Watch Your Ignition

The battery should be strong, the coil and condenser in the best condition, the distributor clean inside and outside, and the high tension wiring well insulated. If the insulation is old or rotted, new wiring should be installed. High tension ignition current leaks readily and any leaks will prevent hot sparks at the plug points.

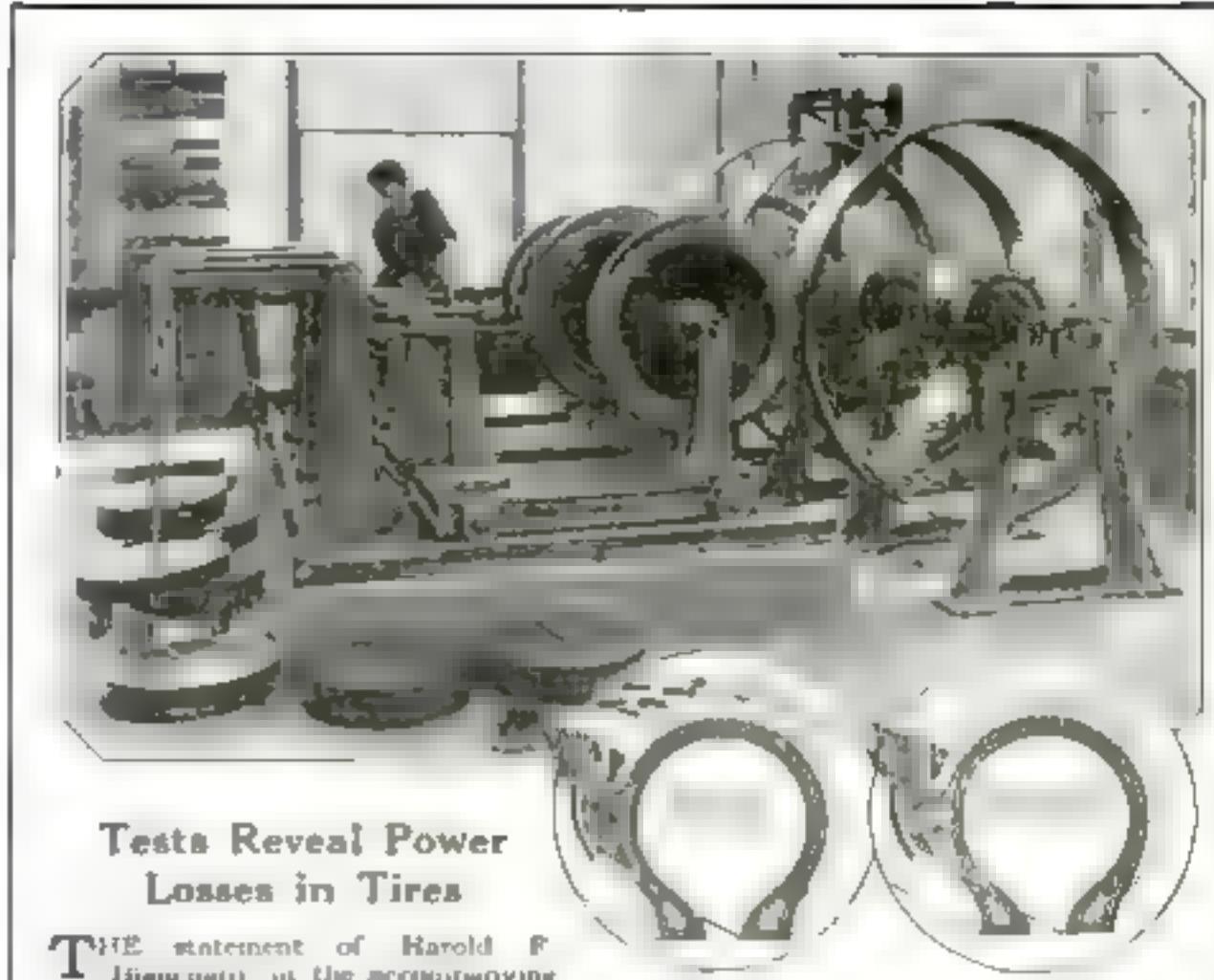
The spark plugs should be clean and the points set accurately .025 of an inch apart. This distance is approximately three eighths of a sixteenth of an inch, or half the thickness of a new dime.

The friction generated by pistons, rings and bearings is an extremely important item of power absorption to the racing driver. He fits pistons, rings and bearings somewhat loosely to minimize friction and eliminate the danger of these parts binding at excessive speeds. To compensate for the loose fit, he uses heavy oil. But heavy oil causes carbon to accumulate quickly in the cylinders and therefore is not suited to the needs of the average car owner. The lighter the oil, the less the carbon deposit. It is best, in the long run, to use oil recommended by the manufacturer, and to change it frequently—at least every 600 miles.

That Pesky Carburetor

The pistons should work freely and the rings should not press too heavily against the cylinder walls. Whenever new rings are installed, it is well to see that they offer a minimum of friction, and that the bearings are not drawn up too tightly by the repairman.

In carburetor adjustment, it is a good idea to remove the carburetor, clean it thoroughly and then install a gasoline filter in the line, to eliminate trouble with dirt and water in the fuel. There is a tremendous difference—as much as 25 per cent—in the way any carburetor will serve different engines. If you think that your present carburetor is not satisfactory, before trying another make, be sure that the one you have is in the best of condition and in good adjustment. You will save needless expense.



Tests Reveal Power Losses in Tires

THIS statement of Harold P. Diamond, in the accompanying article, that power consumption of a cord tire is less than that of a fabric tire, is interestingly corroborated by remarkable tire tests recently completed by the United States Bureau of Standards in its laboratory at Washington, D. C. In these tests, which conclusively demonstrated that cords absorb a third less power than fabrics, the tires were subjected to friction in an ingenious machine (shown above) that duplicated normal road conditions. Construction of the two types of tires is shown in the inset.

For the tests, each tire, attached to an electric dynamometer, is pressed into contact with a pulley driven by a 10 horsepower electric motor. The surface of the pulley corresponds to a smooth macadam

road. By increasing the speed of the motor, the tire can be rotated at a speed equal to that of an automobile traveling 50 miles an hour.

A close approximation of the lost power is gained by computing the energy input to the pulley motor and the energy output of the dynamometer. Since the efficiency of the two electric motors is known, the energy loss is the difference between the two figures.

An average four inch fabric tire under normal load and air pressure, was found to absorb approximately nine tenths horsepower at 25 miles an hour. Under similar conditions the power loss in a cord tire was six tenths horsepower.

The column of air sucked into the engine through the carburetor and through the tortuous passages forming the intake manifold may be compared with an endless elastic rope. If the sides of the manifold are rough, it is clear that the rope cannot be pulled in as fast as if the sides were smooth. Therefore the intake and exhaust passages of a racing engine are scraped as smooth as possible. Car owners who will go to this trouble will discover at once an increase in power production at maximum engine speeds.

New pistons should be of light cast iron

or of aluminum. Light pistons not only reduce vibration, but reduce pressure on the cylinder walls and bearings.

In tuning up the engine be sure that the spark advance mechanism works and that when the accelerator pedal is pushed all the way down, the throttle is fully open. Sometimes the extreme movement of the accelerator pedal brings the throttle past full opening to a slightly closed position.

The clutch should not slip, even slightly. If it does, wash it with kerosene if it is a dry disk or plate type, and if this does not cure the trouble, adjust it. If the clutch is

Five Secrets of Car Tuning that Add to Reserve Power

1



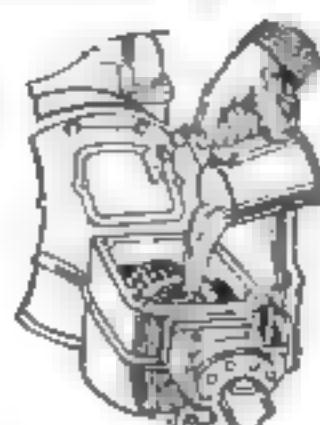
Scrape the sides of the intake and exhaust manifold passages until they are smooth, to permit unobstructed passage of air into the engine

2



Grind the valves, remove the carbon, and adjust carefully

3



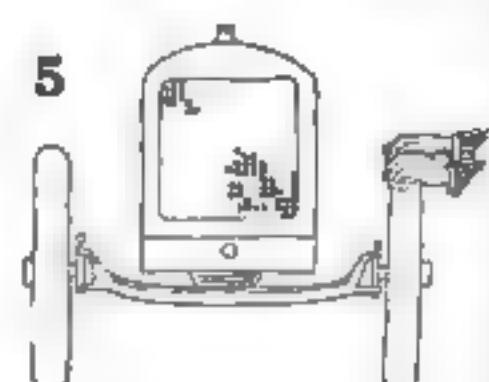
After cleaning transmission with kerosene, fill gearbox half full of lubricating oil

4



Set spark plug points apart a distance of half the thickness of a new dime

5



Set wheel bearings so that, when shaken, they will have about one sixteenth inch play

How to Keep Your Car at 100 Per Cent Efficiency

TO PREVENT the door pocket—the handiest place to carry automobile tools—from tearing away from the wooden crosspiece that the car has halfway up the door, fasten the pocket with a row of carpet tacks spaced about one inch apart. Two tack holes can be closed by tapping them into the beading of upholsterer's tape.



TWO spares are held on one tire carrier by a simple iron extension driven between the rim of first spare and tire carrier. Near the outside end of the extension, which projects far enough to support the second spare shown in phantom at the right, drill a hole to receive the valve. Strap the tires together.



SOULEAKY brakes can be cured, without danger of lubricating the brake drum, by the use of fuller's earth. To apply, shake fuller's earth in gasoline and beat the fine powder settles, squirt it between the band and the drum with an oilcan.

A cone, dust fuller's earth on the facing if it seems too oily, and adjust if necessary. A metal to metal multiple disk clutch that slips may be cleaned with kerosene and then covered with a lubricant consisting of a mixture of one part kerosene with one part cylinder oil.

The transmission should be drained, cleaned with kerosene, and partly filled with ordinary engine lubricating oil. If this leaks out, use a heavier oil. Treat the rear axle in the same way. If the lubricant leaks out around the wheels, the trouble usually may be eliminated by putting only enough oil in the axle to permit the big bevel gear to dip well into it. The wheel bearings should be lubricated with a very light grease.

The wheel bearings, if adjustable, should be set so that the wheels, when shaken, will have about one sixteenth inch play. Be careful, however, not to confuse this play with play in the steering mechanism. The rear wheels should spin with perfect freedom. Dragging brakes can be remedied by careful adjustment, according to the manufacturer's directions. If the brakes fail to release readily, joints may be rusted or it may be they require oiling.

Possibly some of the release springs may have lost their strength, broken or fallen off. In some cases it is advisable to install heavier springs, anchoring them to some

convenient point on the chassis by three sixteenths inch wire. If contracting brakes are used on the rear drums, be sure that the small release spring located at the point where the band is anchored to the axle is in working order. Sometimes the screw at

varies with the tire. A few years ago one of the big tire companies produced a cord tire with smooth tread designed especially for racing. Actual tests by racing drivers on the wooden saucer at Sheephead Bay, New York, proved that these tires on an automobile traveling 200 miles an hour were four miles an hour faster than other tires. Since approximately 100 horsepower is required to propel a racing car at this rate, it was estimated that the saving effected by these tires was equivalent to eight horsepower.

Every man in the racing game knows that power consumed by cord tires varies with the tire, but that the power consumption of the cord tire is always less than that of the fabric tire; further, that a tire pumped to 10 pounds in excess of manufacturer's rating absorbs less power than one with less air pressure.

The racing man's steering gear is always well lubricated and in good adjustment. The nuts are always tight and the cotter pins in place. Steering gear should get close attention.

Keeping your car in racing-car tune saves fuel bills and tire and repair expense. The car will wear longer because its parts are systematically lubricated. Once the whole car is "right," it is easy to keep it that way. And that is the way that gives the greatest satisfaction and economy.

Know Your Car

HAVE you ever asked yourself just how thoroughly you know your car and its ways? Do you realize how much greater mileage you could get for the same cost if you gave your car something like the care that the racing driver gives his? The racing driver not only tunes up his engine to give a maximum power output, but he also adjusts each detail of his car, so that the amount of power that it absorbs is at a minimum.

The difference between power produced and power absorbed is the power that is available for speed—that is, the power that is available for overcoming wind resistance. It is comparable to the business man's profit. You can take that profit on your own car just as easily, if you know how to give it the attention it deserves.

The series of remarkably helpful articles by H. F. Blanchard, appearing in these pages every month, is helping hundreds of readers to increase their pleasure in motoring, while decreasing the expense of running their cars.

this point needs adjusting. Even if the brakes drag only slightly, they will noticeably retard the car.

Tires, when pumped hard, roll with less friction. The amount of power consumed

Novel Automobile Robe Unrolls like Window Shade

Ten Other Useful Inventions for Car Owners



This wide seat belt for the leather bucket seats is attached to the side of the seat by means of two leather straps.



Large piece of rubber sponge, as shown above, may be used as an emergency part of an auto radio. Hold for packing.



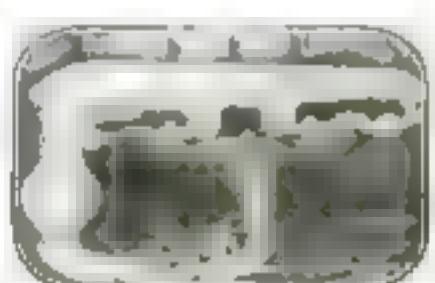
This novel robe is unrolled from the small pocket shown at the right. When rolled up it will fit in the front pocket.



For securing the attachment of each above strap to the leather upholstery, take out the leather rivets.



Fitting the valve stem into the valve body, which is held in hand, so that it holds up valve head.



A novel short-circuiting device, designed to keep batteries from shorting out in the field, is shown above. It is made of copper wire.



This steel strap, made of leather and with a short loop, will save your back in your seat belt.



With six setscrews attached to the outside of the hub, this powerful screw, operated by a crank handle, enables one person to pull the tightest wheel.



The auxiliary tank shown above is triangular in cross section and when covered makes a good lantern.



Installed at the base of water jacket, this electric heater keeps the engine from freezing.



A new volt checker for storage batteries has two fixed contacts operated with one hand.

Primer Made for Less than a Dollar

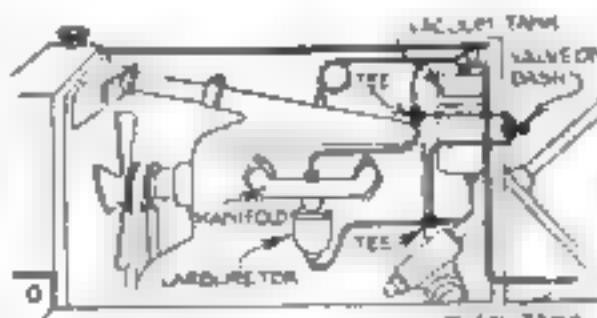
WITH the first cold mornings, the motor-car owner begins to feel the need of some kind of a priming device to assure the quick starting of his motor. Probably the best system is one that provides for injecting gasoline into the intake manifold as near the cylinder block as possible, and preferably it should be operated from the dash.

For less than a dollar any one can fit such a primer to his motor, if it has a vacuum gasoline system. The vacuum tank is connected with the intake manifold by a copper tube.

Obtain two solderless tees of the proper size to fit the intake tube that carries gasoline from the vacuum tank to the carburetor as well as sufficient flexible metal tubing to reach from the manifold to the dash and back to the gasoline line. A small shut-off valve to fit this also should be purchased.

Cut the tube running to the manifold

By G. W. Greene



Valve on dash makes it easy to provide rich starting mixture

as far down as convenient. Fit in the tee, with the additional tubing running from it, and place the shut-off valve conveniently on the dash. Then, by means of the other tee, connect this tube with the gasoline line between the vacuum tank and the carburetor. The gasoline may be shut off while doing this by means of the shut-off valve on the bottom of the tank, or the tank can be emptied.

To use the primer it is necessary only to open the

valve on the dash, allowing the suction of the motor to draw the liquid gasoline into the manifold. The best results can be obtained by opening the valve in the primer when stopping the car at night. When the motor is idling, the valve may be opened and the heavy rich mixture entering the cylinders will flood and stop the motor. Then turn off the ignition. When the motor is again started, the rich mixture in the cylinders will fire.

Asbestos Tape on Manifolds Conserves Heat in Winter

HEAT is the one necessary thing to turn raw gasoline into power. The illustration shown herewith explains a very simple aid to breaking up the fuel by wrapping both the inlet and exhaust manifolds with woven asbestos tape. This utilizes the waste heat of the exhaust pipe to heat fresh, cool, incoming gases.

Procure a quantity of woven asbestos tape at any automobile-supply house and wrap both as indicated. The asbestos, being a non-conductor of heat, confines the heat to the exposed surface of the intake.

Every motorist will agree that 90 per cent of starting troubles are caused by condensation of gasoline in the inlet manifold



Warm air passes from exhaust pipe to intake manifold

In cold weather, the tape is wound neatly, one strip overlapping the other, so as to form a solid wall to keep the warm air in and the cold air out.—RONALD L. PRINBLE.

Raising Spark Plug Prevents Formation of Carbon

GO TO any hardware store or plumbing shop and buy $\frac{1}{4}$ -in. male and $\frac{3}{8}$ -in. female fittings. Put on plenty of shellac and screw in top of the cylinders in place of

the spark plugs, then shellac your plugs and screw in the fittings. This raises the plugs in the fittings and protects them from the splash of the oil and the carbon from gasoline.

I tried the above on my Ford and never had any trouble with dirty plugs. I believe

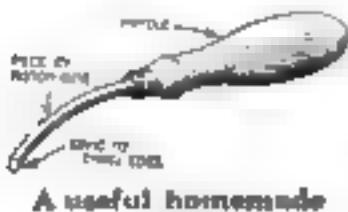
it also gives more power to the engine. Be sure that the fittings are screwed on tightly.—EARL E. MOON.

Tool Made of Old Piston Ring Cleans Grooves

IN FITTING new rings to old pistons it is highly essential to clean the piston ring grooves of carbon and other accumulations. Otherwise, the new piston rings

will not work properly because their freedom of movement will be restricted by the dirt in the grooves.

An excellent



A useful homemade scraper

tool for thoroughly cleaning the grooves can be made from an old piston ring, a section of which is ground to a chisel edge and mounted in a handle.—H. F. B.

Keeping the spark plug clean means less engine trouble

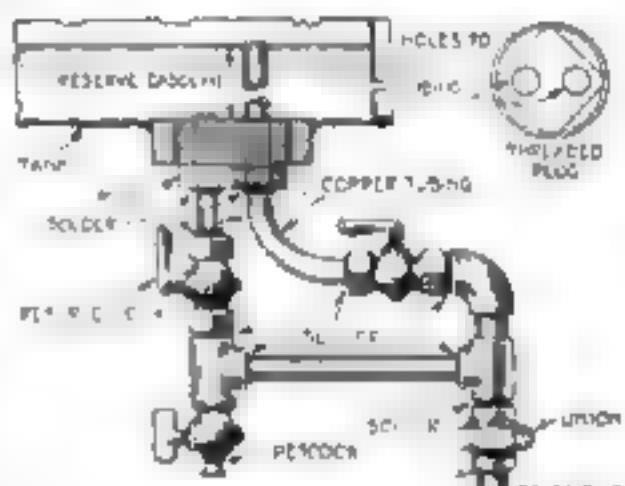
To Insure a Reserve Supply of Gasoline

YOU will not be caught without gasoline if you install the reserve device, illustrated at the right, in your auto or motor boat.

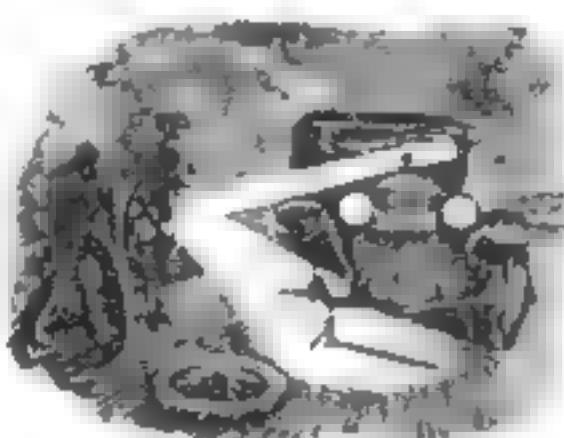
The plug at the tank outlet must be large enough to take the $\frac{1}{4}$ -in. holes for the seamless tubing. One tube extends into the tank about 3 or 4 in. so that the gasoline below it cannot be used unless the reserve cock is turned on.

The amount of the reserve can be found by pouring into the tank known quantities of water or gasoline until it starts to run out of the pipe extending into the tank.

Solder all connections except at the union and where the plug screws into the tank.—HENRY S. LARSON



Emergency supply of gas is made available through reserve cock



Mirror Aids Night Repairs on the Automobile

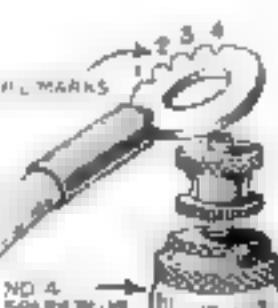
OFTEN when there is no trouble light at hand for making emergency automobile repairs at night, a mirror can be used in conjunction with the spotlight to illuminate practically any part of the car. The spotlight is focused on the mirror, by which the light is reflected to the spot where it is desired.—L. G.

File Marks Identify Spark Plug Leads

ANY one who has been unfortunate enough to crank an engine on which the spark plug wires were misplaced, will appreciate the value of the suggestion that spark plug terminals should be marked to correspond with cylinders of the engine.

This method is used by a Washington, D. C., tractor owner and is found advantageous because of the frequent necessity for changing and cleaning plugs.

A V groove for No. 1 cylinder, two ticks for No. 2, and so on for all the leads, are made with a triangular file and will aid in reassembling.—G. A. LUERS.



Marks correspond with cylinder



The Home Workshop

New and Useful Things to Make with Tools

How to Make a Tea Wagon at Half Store Prices

EVERY woman who entertains, no matter how infrequently, wants one of those attractive tea wagons that are becoming increasingly popular in well furnished homes, serving often as informal luncheon tables. Not only are they ornamental, but they also save steps in carrying food from kitchen to dining room and in clearing the table after meals.

Exercise Care in Building

To make a tea wagon in your home workshop costs considerably less than to buy one, and if sufficient care is taken with the design, workmanship, and finishing, the one you build is apt to have the charm and distinction that give value to handmade furniture.

Success in building a tea wagon or any similar piece of furniture depends largely on having a good design and an adequate drawing or layout from which to work. For that reason the Home Workshop Department has prepared a blueprint giving additional details of the tea wagon, the construction of which is described and illustrated in this article. This tea wagon combines the best features developed by furniture designers, simplified in construction as far as possible for the home worker who must rely almost entirely on hand tools.

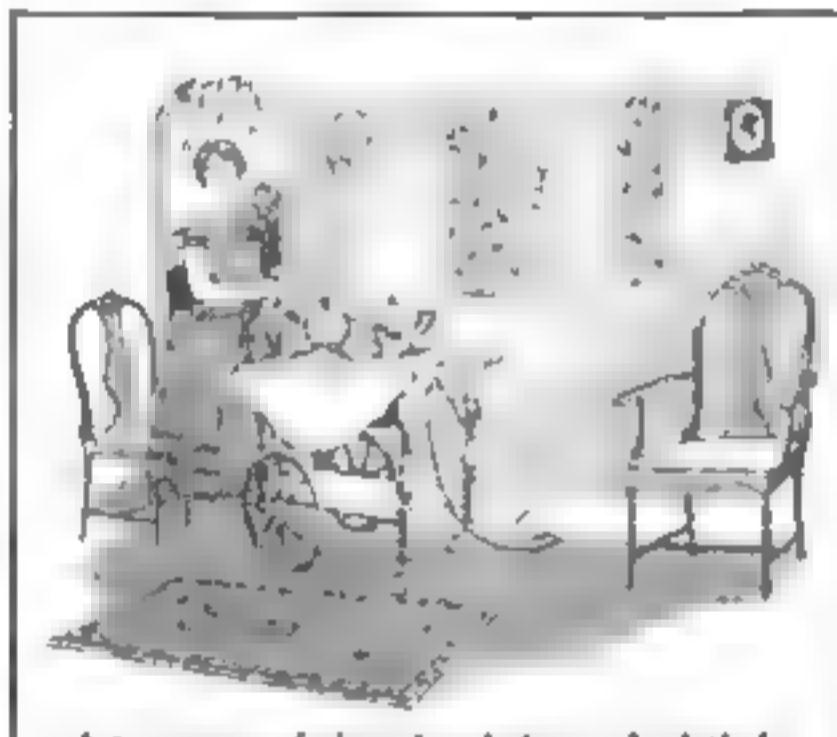
A Wide Choice of Designs

Since this is a strictly conventional tea wagon of the more expensive type, the general dimensions and constructive details, many of them full size, can be used as a basis in making innumerable changes in design. For instance, the legs may be turned or straight, the leaves or tray may be omitted, and the handle may be of wood or metal, or a combination of both; the wheels may be purchased, turned, or cut out with a saw. Any number of these variations will be suggested in the accompanying illustrations and following text.

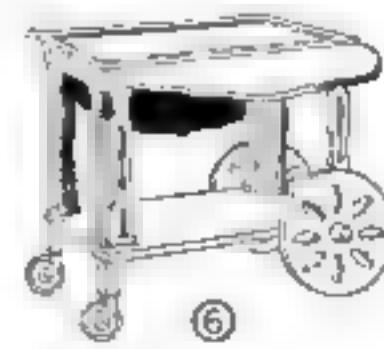
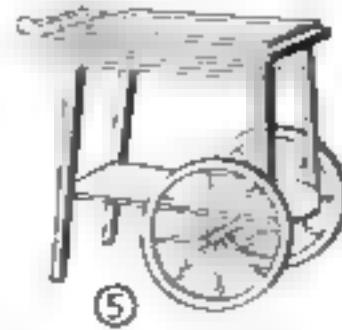
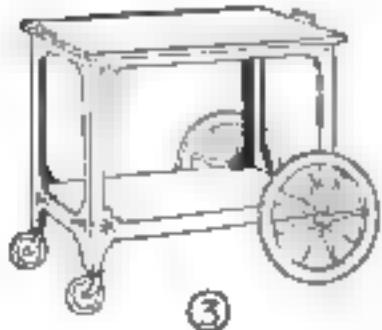
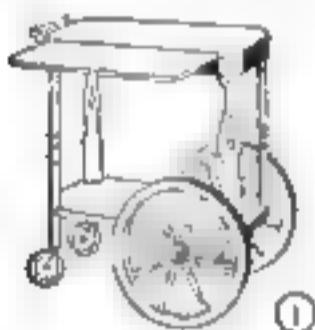
The general dimensions and construction are well illustrated on page 90 in the side and end views of the tea

Any one of the nine handsome types of tea wagons shown herewith may be made as a variant from the Home Workshop's fundamental blueprint design.

*A Handsome Piece of Furniture
for Your Home or a Useful
Christmas Gift*



A tea wagon of charming design and relatively simple construction, described in the accompanying article, for which additional working details are contained in Home Workshop Blueprint No. 13. See pages 90 and 91.



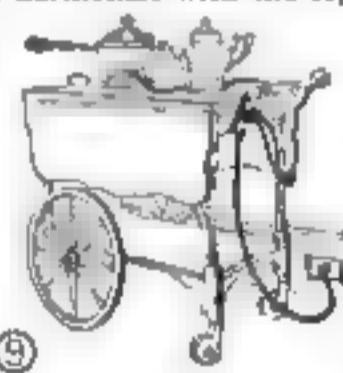
wagon, designed for the blueprint service. Commercial tea wagons do not vary a great deal in size, although the cheaper ones are often a trifle small and light. It is not the size so much as the design, material, and workmanship that influence the cost of manufactured tea wagons. They range in price from \$20 or even less, but the average well built tea wagon costs between \$30 and \$40. An inlaid mahogany table, somewhat similar to No. 6 below, is listed in a New York department store for \$90. The difference in the cost of material between a cheap and an expensive tea wagon is not a great deal, so it will pay the man who wishes to make one to work up one of the better models, which he can do at less than half the store cost.

Describing Some Wagons

The design marked No. 1 is a novel and interesting variation in that the corners are cut off and the legs sawed from $\frac{1}{2}$ -in. stock, set at an angle. This displays well the distinctive profile of the legs without the appearance of thinness that would result if they were parallel with one of the main axes of

the wagon. The leaves are rectangular in general shape, but have the outside corners cut off at an angle to harmonize with the top.

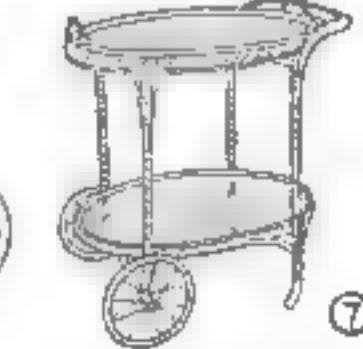
Number 2 is a little heavier tea wagon with 8 light, straight legs, each pair being set back a trifle from the corner. The small blocks at the bottom and top form a sort of base and capital for them. The middle shelf has the corners cut off between the legs, but the lower shelf is rectangular, like the top. This tea wagon has a wooden handle, and the tray has metal handles.



The Simplest Model

In No. 3 is illustrated the simplest and easiest model of them all. Two frames are made for the sides and two for the end, and the four are then fastened together with glue and brads. Cove-shaped corner blocks are used to

(Continued on page 90)



The following article contains specific instructions for installing fuel saving improvements in your heating plant, as recommended last month in a survey of the house heating problem

How You Can Improve Your Home Heating Plant

Cut Coal Bills by Better Distribution and Conservation of Heat

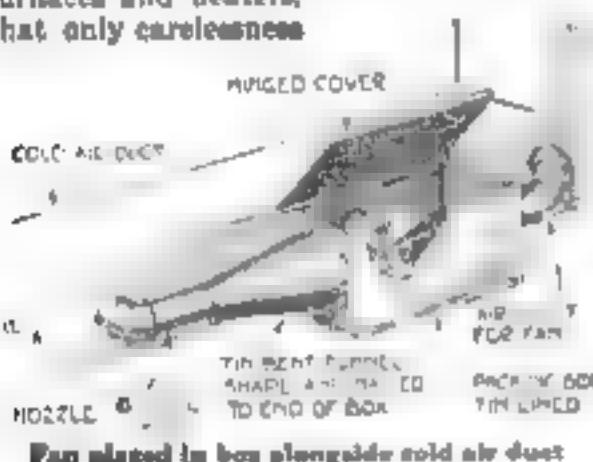
IN MANY ways the home worker can make improvements in his heating plant and his house that will repay themselves over and over again, both in the saving of coal and the increase of comfort during the winter.

The installations and methods suggested below have been tried and tested and none of them is too difficult or costly to be undertaken by any man with a little ingenuity and a few of the ordinary tools that are or should be in every household.

To decide just where to begin improving the heating arrangements of a house is often a problem. In many cases the efficiency of a heating plant can be increased from 25 to 50 per cent, with a corresponding reduction in the coal bill; in other instances it is next to impossible to better the heating arrangements without changing the plant entirely or remodeling the house. Generally speaking, increased efficiency can be obtained by one or more of the following methods:

1. Operating the furnace more economically.
2. Distributing the heat more thoroughly and evenly.
3. Preventing waste of heat.
4. Providing a proper degree of humidity in the air.

So much has been written and so much advice given on how to operate all types of furnaces and heaters, that only carelessness

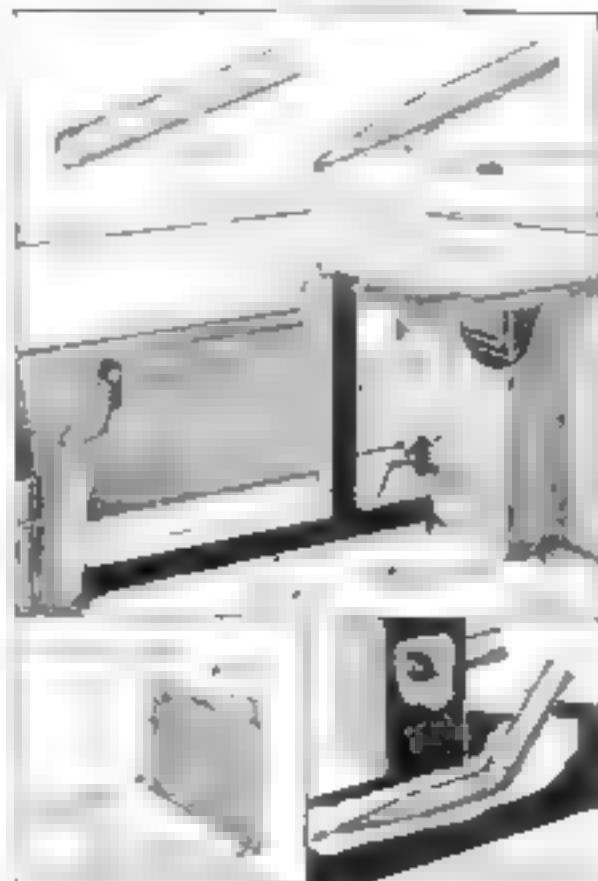


or indifference is responsible for losses due to poor regulation of the fire. In nearly every case, however, further improvement can be made by substituting automatic regulation by means of a thermostatic device. These are conducive to more even temperature throughout the house and prevent the losses caused by overheating at some times and allowing the fire to get too low at others. The home worker will find it comparatively simple either to install one of the commercial thermostatic regulators or to make one of his own as told in detail below.

Heat Distribution Is Problem

More important still is the question of distribution. Most warm air pipe furnaces, which constitute the larger proportion of heating plants throughout the country, are notoriously inefficient in this regard. Nine-tenths of the difficulty encountered with these furnaces can be overcome by using a blower or fan to assist the recirculation of air through the radiator or hot air chamber. It is a simple matter to construct one

By James S. Godfrey

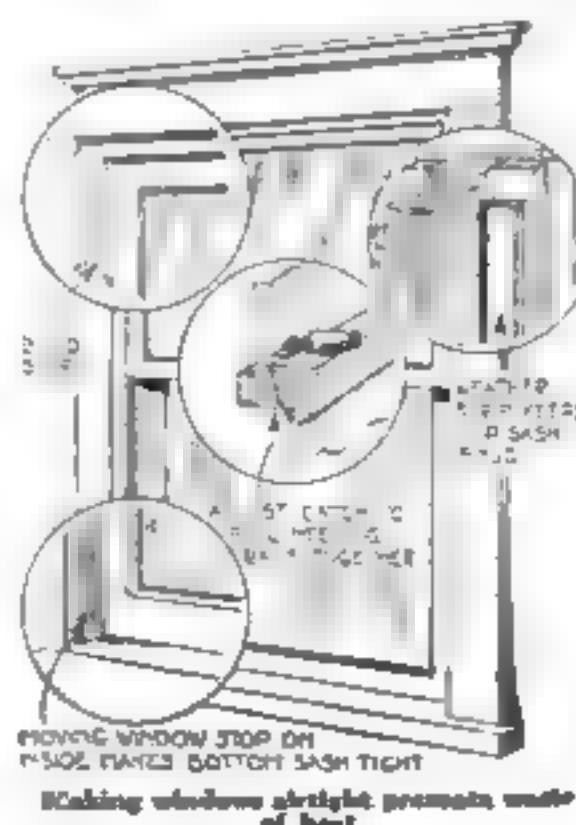


Recirculating air with the aid of a fan. Details show how the injector and cold air shut off are made

of these injectors if electricity is available for operating a fan or blower, and the accompanying instructions and illustrations give a method that can be adapted for most furnace installations.

The conservation of heat is also of great importance. The home worker should go from cellar to garret looking for places where he can prevent the escape of warmth that represents actual dollars and cents. Where to look for these "leaks" and how to prevent them is graphically explained on a following page.

Still another source of waste lies in the fact that most homes do not have sufficient moisture in the air during the winter. More heat is required for comfort when the air is too dry and, therefore, any system of

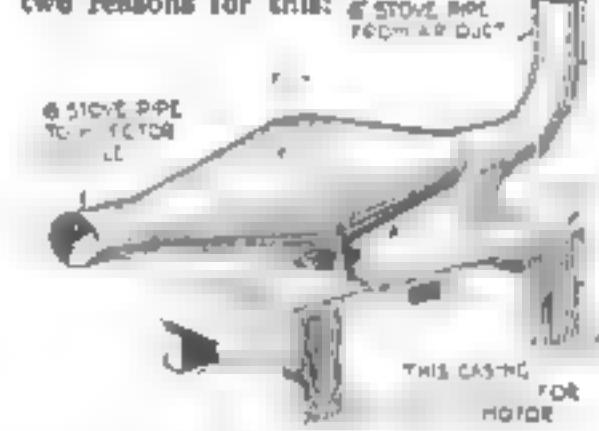


increasing the humidity will indirectly reduce the coal bills and at the same time make the house more comfortable and a healthier place in which to live. There are a number of ways of increasing the humidity and some of the best of these are described below. Instructions are also given for making a hygrometer for measuring humidity, for it is as difficult to preserve the proper degree of moisture in the air without means of measuring it as it is to keep the house evenly warmed without a thermometer.

How to Install a Blower

To overcome most of the difficulties of the ordinary hot air pipe furnace, it is necessary to increase the amount of air passing through the furnace. This can be accomplished very simply with an ordinary electric fan or a ventilating fan or blower.

The best location for the blower is in or near the so-called cold air duct or inlet pipe. Obviously it is useless to make this installation if the inlet pipe feeds directly from outdoors, because the fan then simply blows more cold air than usual into the furnace and decreases rather than increases the efficiency of the heating plant. The air must come from inside the house, at least in larger part. There are two reasons for this:



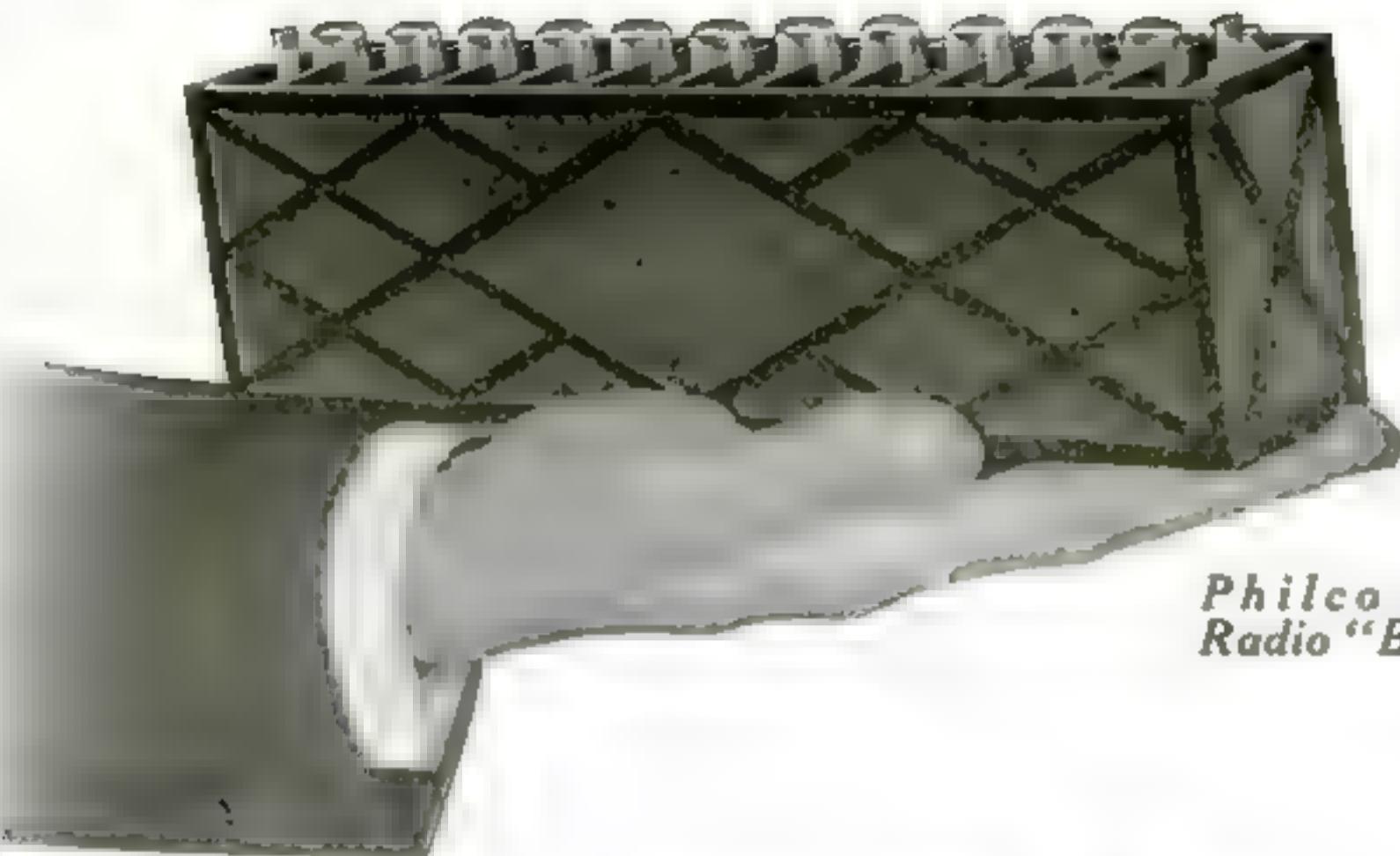
Casing of galvanized iron used for enclosing fan

one is that to force unduly large quantities of outside air through the furnace taxes it unnecessarily, and since the air has no means of outlet except through the window openings and door cracks, and the like, a high back pressure is created and hinders the correct distribution of the heat.

The first step, therefore, is to provide an indoor intake. This can be done by running a pipe of No. 26 United States standard gage galvanized sheet iron or a framework covered with tin, sheet asbestos or plaster boards, from a floor radiator on the first floor down to the regular intake pipe. The radiator should be located in some relatively cold corner, usually in the hall. A hinged or pivoted cut-off, as shown, can be arranged in the most convenient manner to permit either cold air, indoor air, or any proportion of the two being supplied to the furnace.

The next step is to provide for forcing a jet of air into the inlet pipe with a blower, which should not be placed too near the furnace. All that is necessary to do is to fit a conical casing in front of the fan, as illus-

(Continued on page 100)



*Philco Drydynamic
Radio "B" Battery*

Born the day you get them

The life of a new Philco Drydynamic Radio Battery starts when you pour in the Philco Electrolyte—not weeks or months before at the factory. And no initial charging is necessary.

That means you can now get, for the first time in history, a charged, 100 per cent new storage battery the day you need it—a revolutionary development in battery engineering.

Philco Drydynamic Radio Batteries are CHARGED DRY at the factory. Just add Philco Electrolyte and they're ready for use. No waiting for initial charging. No paying for battery life lost on the dealer's shelf.

What is even more important—Philco Drydynamic Batteries, for both "A" and "B" Circuits, give you longer service per charge and last longer than any radio battery ever built. And their uniform current insures absolute freedom from "frying," "cracking" noises.

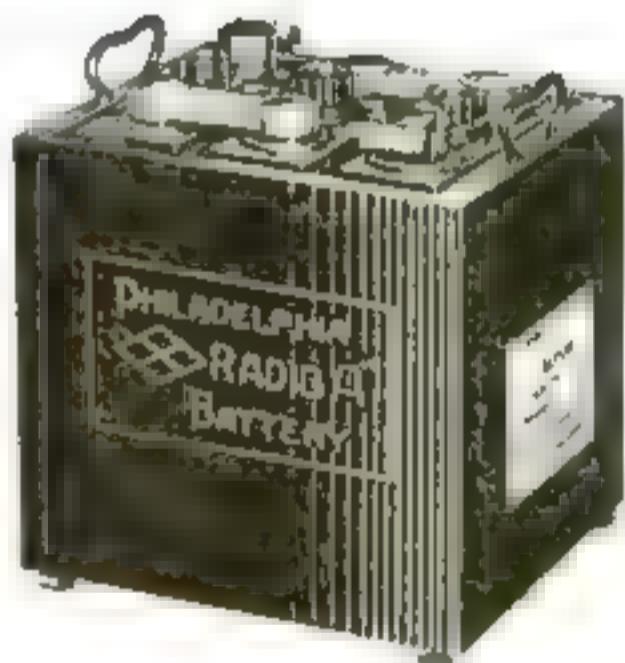
Why invite the annoyance of frequently tuning in—of having your pleasure spoiled by disturbing noises? Get the best possible results from your radio by installing these wonderful new Philco Drydynamic Batteries NOW.

Ask your radio dealer for them or go to the nearest Philadelphia Diamond-Grid Battery Service Station.

RADIO DEALERS Philco Drydynamic Batteries let you into the battery business on a package goods basis. No acid stoppage. No charging equipment. No batteries going bad in stock. Wire or write for details.

Philadelphia Storage Battery Company, Philadelphia.

Makers of the famous Philco Slotted-Retainer Batteries—standard for automobiles, electric passenger cars and trucks, mine locomotives and other high-power, heavy-duty battery services.



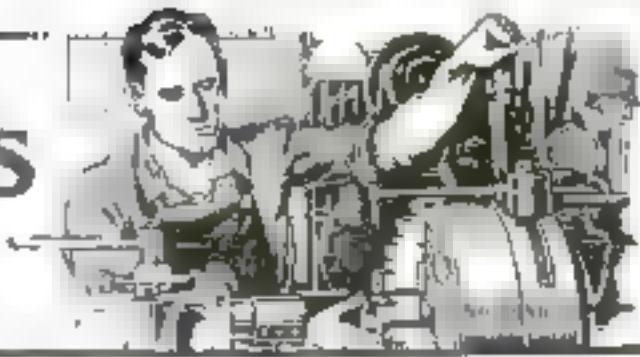
*Philco Drydynamic
Radio "A" Battery*

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Better Shop Methods

How Expert Mechanics Save Time and Labor



Shaper and Planer Attachment for the Lathe

Serves Many Purposes of Large Shaper at a Fraction of the Cost

MACHINE shops, tool rooms, and automobile repair shops will find the shaper attachment illustrated a valuable addition to the engine lathe. With its aid, shaping and planing operations of many kinds can be performed, slots, keyways, and splines can be cut, taps and reamers grooved, and all sorts of irregular, angular shapes machined.

To obtain the maximum utility of range and action from the attachment, it has been designed for use in two different ways:

1. Mounted on the lathe faceplate, it machines work held on a table fastened to the compound toolrest. In this way it really serves as a planer, as the work is reciprocated beneath the tool.

2. Held in the toolpost, the shaper head operates on work fastened in a chuck or on the faceplate, or mounted on the lathe ways, resting on a table.

The utility of the shaper goes without saying, but many machine shops, commercial garages, and practically all home model-making workshops have no shaper. A great deal of work, therefore, has to be filed to shape.

With this attachment such labor becomes unnecessary, and if reasonable care is taken in laying out the work, much that is usually done with a large shaper can be accomplished equally well, if not so rapidly, with this machine.

The design has been carefully studied from different angles and is believed to be practically and mechanically well suited for giving the best results under the necessary limitations of range and power. The dimensions shown on the detail drawing are for a shaper attachment suitable for use on a lathe with a swing of from 9 to 18 in. In machine shops where larger lathes

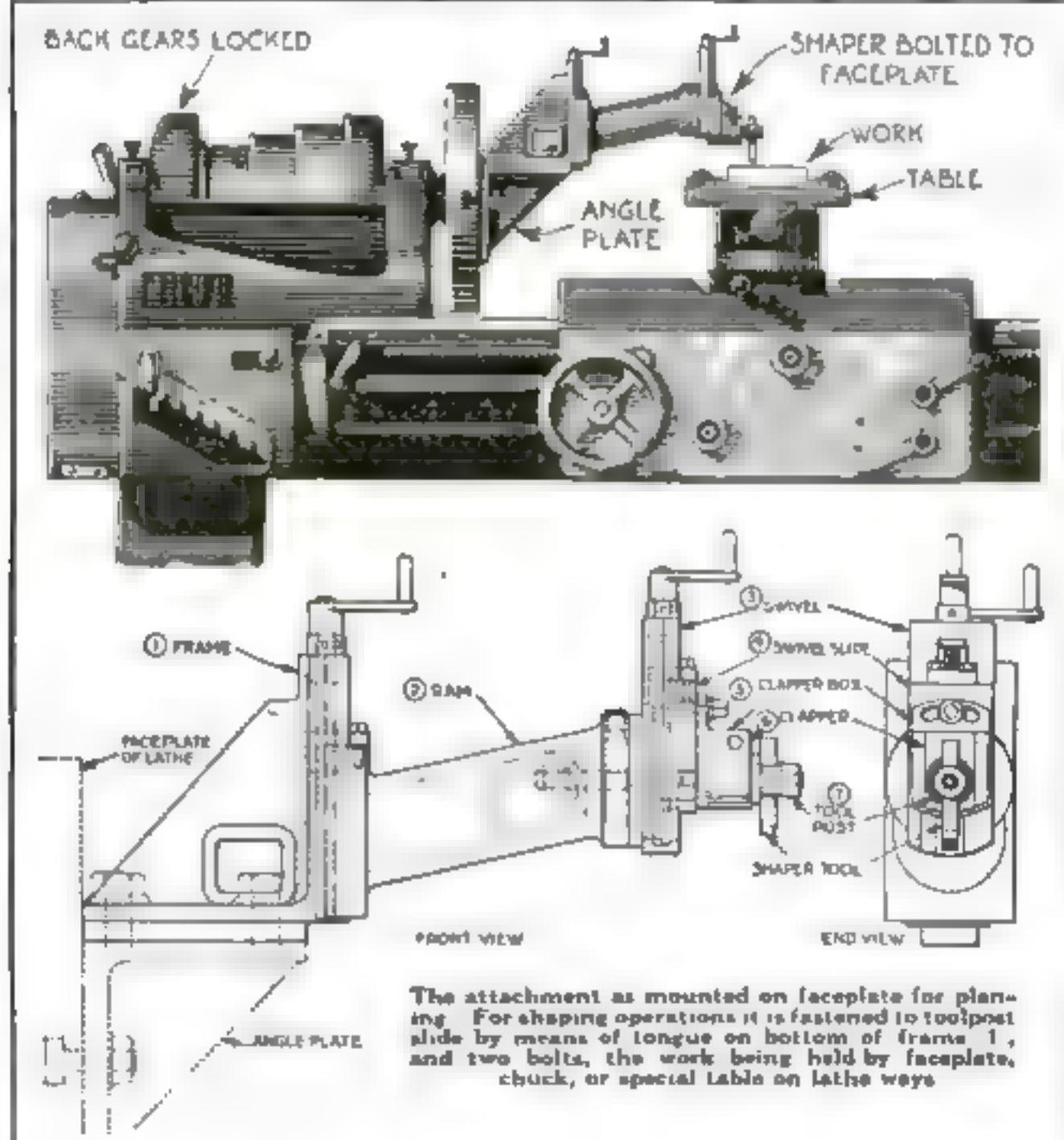
By B. R. Wicks

are used, the attachment can be made heavier all around; in fact, it can be adapted for use on faceplates ranging in size from 3 to 6 ft. or even more.

drawings exactly. Care must be taken that all the parts are absolutely square and true, and the fit of all parts, particularly the slides, are perfectly in line. The slots should be scraped after they have been planed, and care should be taken that the angles match each other.

The tongue on the bottom of the frame, marked No. 1, is planed to fit exactly, without the least shake, in the toolpost slide, and is held in position with two bolts. A special slide can be made, if the builder so desires, but it will be found that with a perfect fit in the toolpost slide, this construction will be rigid enough to stand up under all the shaping operations within the range of the machine.

By taking out the toolpost, part No. 7, and putting in its place a small extension tool holder, keyways in flywheels, pulleys, gears, and cams, as well as oil grooves in bearings and bushings, can be cut on short notice after the holes have been bored and reamed. This can be done before the work has been removed from its position in the chuck or on the faceplate. In the same way it is



The movement of the table or platen when mounted as shown in the accompanying illustration and the movement of the shaper head when similarly held on the toolrest, is obtained by turning the handwheel that operates the lathe carriage. The length of the stroke can be regulated by stops on the lathe ways. If desired, the lead screw can be utilized for performing the work automatically, but this is by no means necessary.

The parts of the shaper do not require any lengthy description, as their shapes and sizes are fully covered in the detail drawings. It is merely necessary to follow the

possible to machine corners that would be difficult or impossible to reach with the ordinary shaper tool.

If a small tool holder is used in the regular toolpost, a large number of tools of various shapes can be made from 8/16-in square self-hardening steel. Taps, reamers, and counterbores can be held in the chuck by the shank and the flutes formed by shaping, the back gear being used for an index. This is a practical method and will be found a great saver of time.

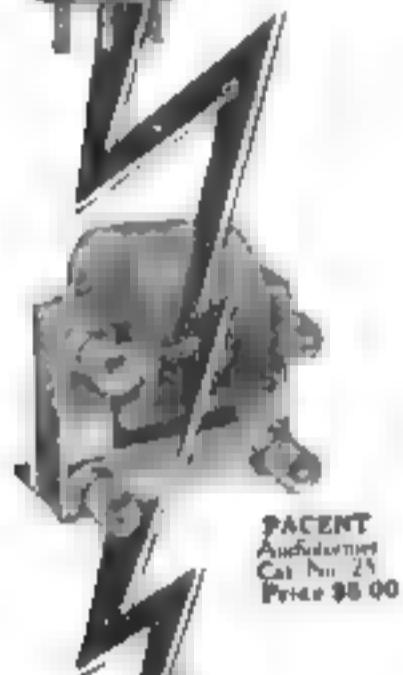
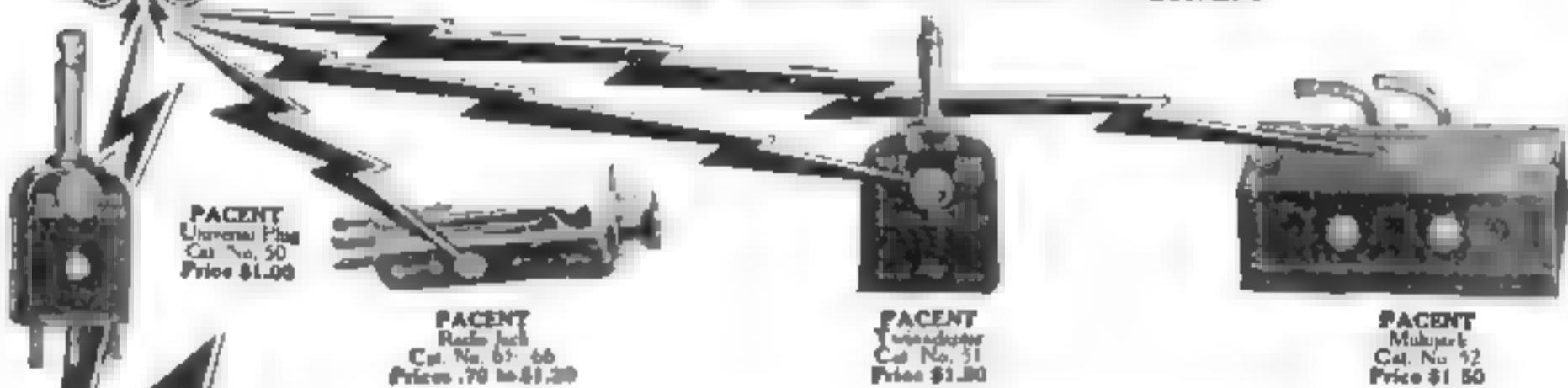
For use with the shaper head when held on the toolrest a table should be made about

(Continued on page 82)



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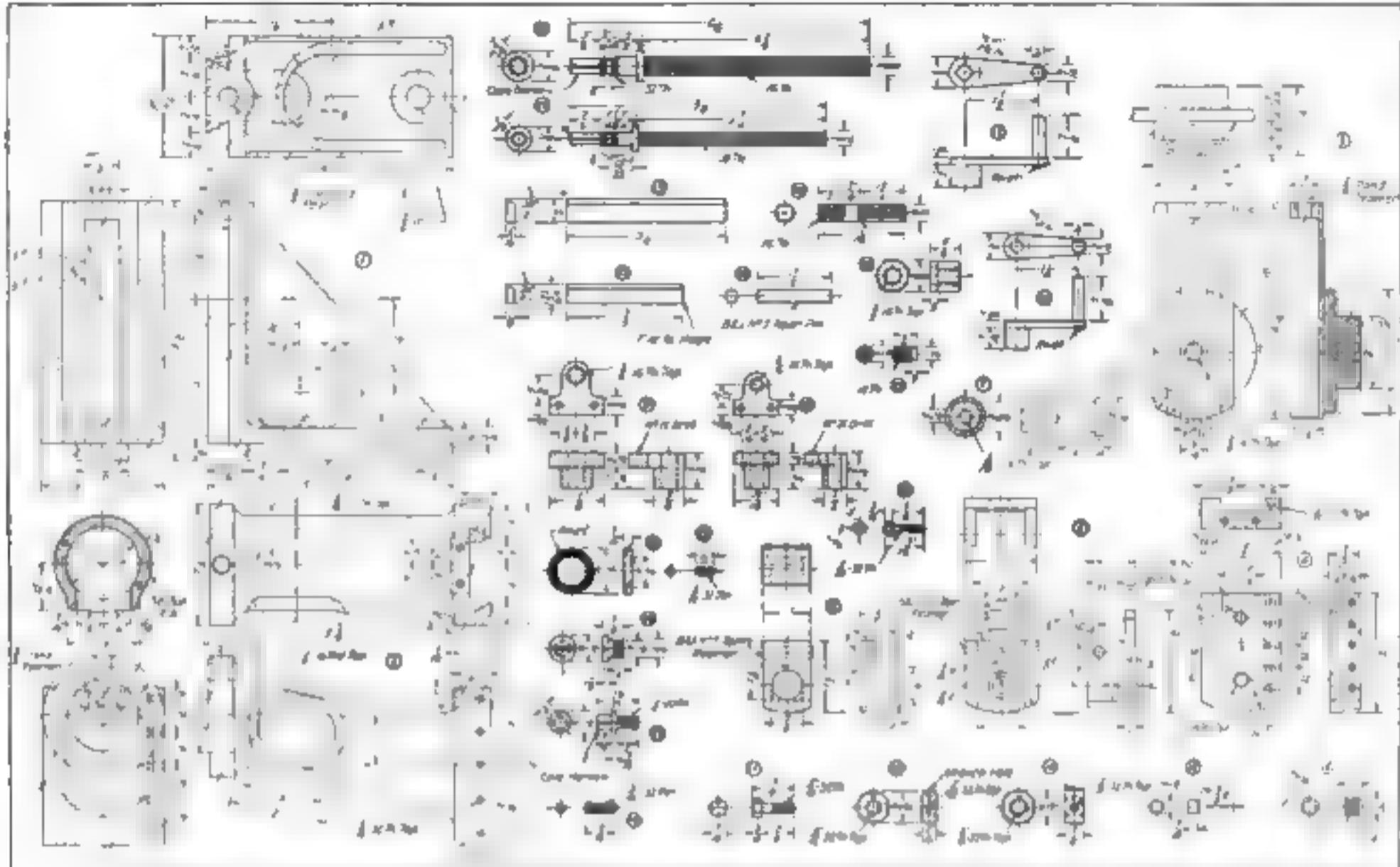
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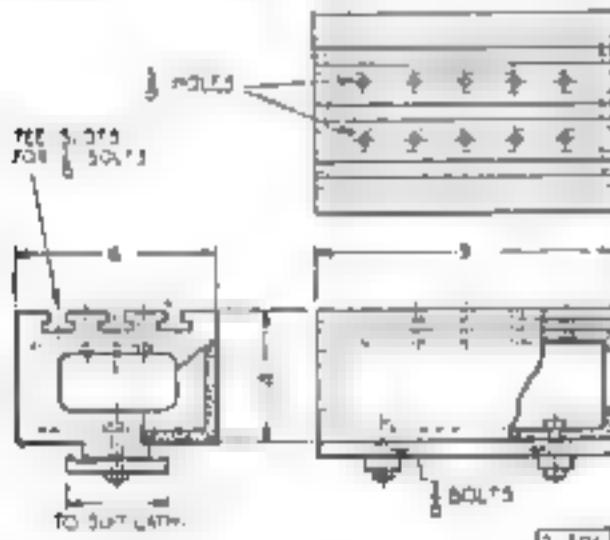


Shaper and Planer Attachment

(Continued from page 80)

6 by 9 in., as shown. On the bottom of the table a tongue is planed to fit the gap between the ways, less $\frac{1}{8}$ in. This $\frac{5}{8}$ -in. space is to provide for a gib to take up all the play by means of set screws in the inside edge of the tongue. The table is held in position between the headstock and carriage by means of two studs and straps that fit under the gap. All the planing on the table can be done with the shaper itself when the table is set up in position.

The bottom of the table must be planed first and the gib placed in position; the holes for the set screws drilled and tapped, and the holes in the bottom of the tongue drilled and tapped, and the studs and straps made. When the table is put into place, the gib is set up by means of the set screws



This special table for holding work is fastened on the bed of the lathe

and the straps tightened by means of nuts on the studs. The table is then rough-planed with a round-nose tool and a light cut is taken, the finishing is then done with

Details of the various parts, the identifying numbers, names, and materials of which are as follows:

1 Frame	C 1	12 Frame side screw handle	M.S.	21 Ram slide screw handle	M.S.
2 Ram	C 1	13 Ram gib	M.S.	22 Swivel gib	C.P.R.
3 Nut	C 1	14 Ram gib set screw	M.S.	23 Swivel gib set screw	M.S.
4 Nut set screw	M.S.	15 Ram side screw handle	M.S.	24 Ram side screw nut	M.S.
5 Clapper base	M.S.	16 Ram side screw	M.S.	25 Major side screw nut	M.S.
6 Clapper	M.S.	17 Ram side screw	M.S.	26 Major side screw	M.S.
7 Toolpost	M.S.	18 Ram side screw collar	M.S.	27 Clapper base bolt	M.S.
8 Frame side screw	M.S.	19 Swivel retaining stud	M.S.	28 S & S taper pin	M.S.
9 Frame side screw nut	M.S.	20 Swivel retaining stud	M.S.	29 Toolpost screw	M.S.
10 Frame side screw collar	M.S.			30 Toolpost collar	M.S.
11 Frame side screw nut lock	M.S.				
I require it	Red.				

a flat-nose tool and about a half turn of the screw, making what is known as a ribbon finish. The slots should be planed very smooth and tested with a size block so that they will be uniform in width, in order that a fixture made for one will fit in the others.

Also plane down on one side so that a try square can be used to square up work, as on a planer platen.

Angle plates, a small vice, a straight edge, and a small set of index centers can also be provided. The height of the table is determined by the swing of the lathe.

When the shaper is strapped to the faceplate of the lathe, a table 5 in. wide and 8 in. long can be made to fit on the carriage slide. This table also should be furnished with T slots. In its manner of working it acts as a small planer platen, so that pieces up to 8 in. in length can be planed on it with ease. A small pair of index centers can be made to fit the table with a swing to about 3 in. and gears can then be cut. By such methods, the full usefulness of the tool can more readily be realized.

It is important that this table for the carriage slide should be planed smooth and true. Before starting to plane it, pit a round pointed tool in the shaper toolpost and bring the point of the tool so that a piece of newspaper will be held just between the point and the top of the tool slide.

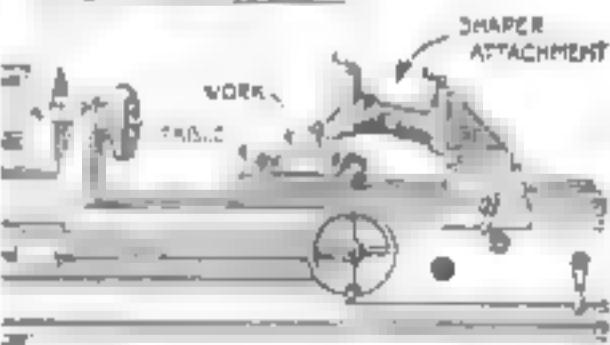
Run the slide over and see if there is any change between the paper and point of the tool on the other side. If there is, throw out the back gears and shift a tooth or two, relocking the gears and repeating the test;

do this until both sides prove alike. Then place the table in position and plane off the top. See that all four corners, when finished, measure alike with the micrometer.

Next, mark the teeth in the tail gear, and drill and ream right through the faceplate into the headstock for a tapered dowel pin, fitted with a nut, so that it can be removed readily when not needed. If pos-



CUTTING A KEYWAY
IN A SHAFT

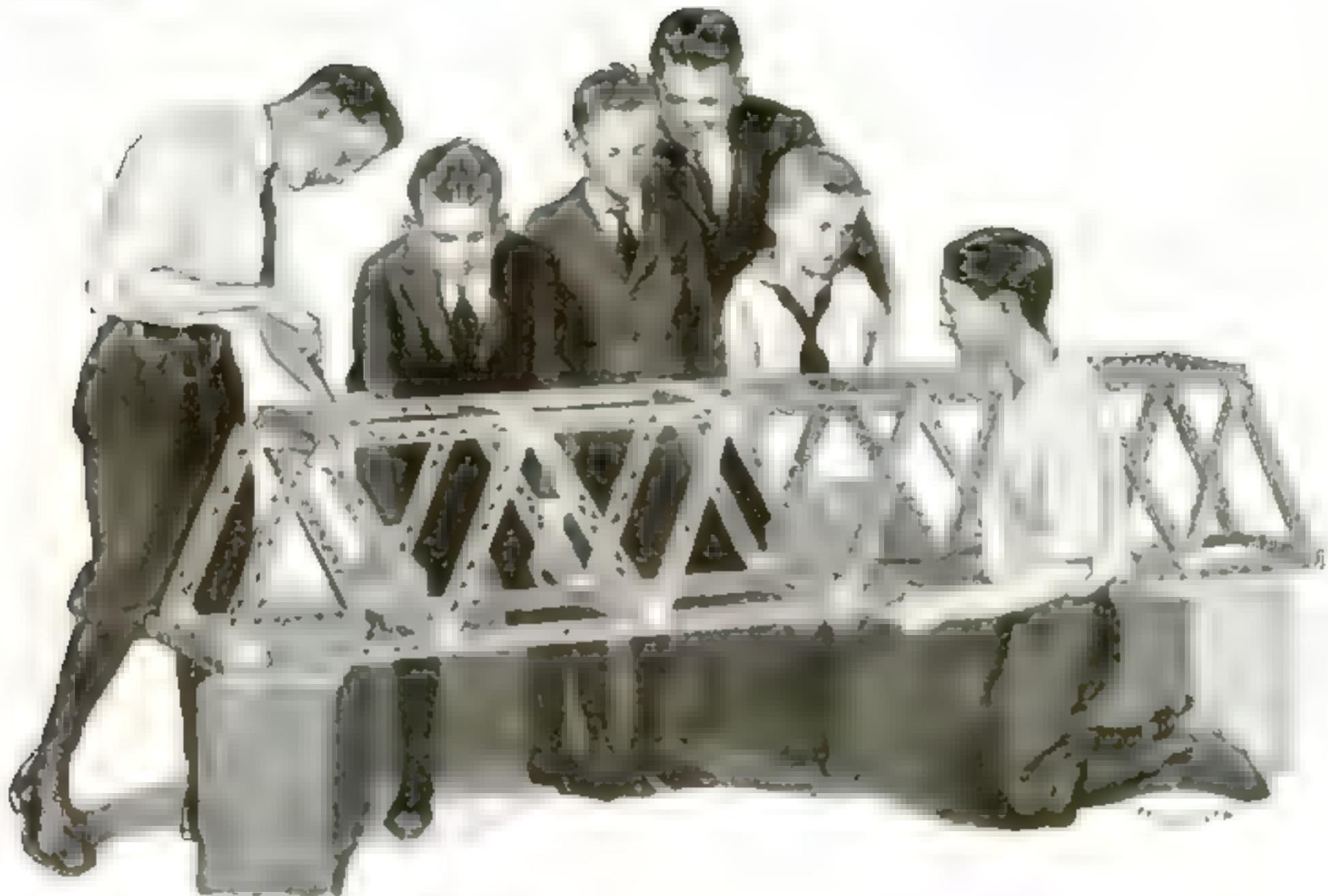


Used in connection with the toolrest, the attachment has wide range of utility

sible, use this faceplate and angle plate only for the shaper attachment.

To save time in setting up the shaper attachment on the faceplate, it is advisable to drill and ream the faceplate and angle

(Continued on page 84)



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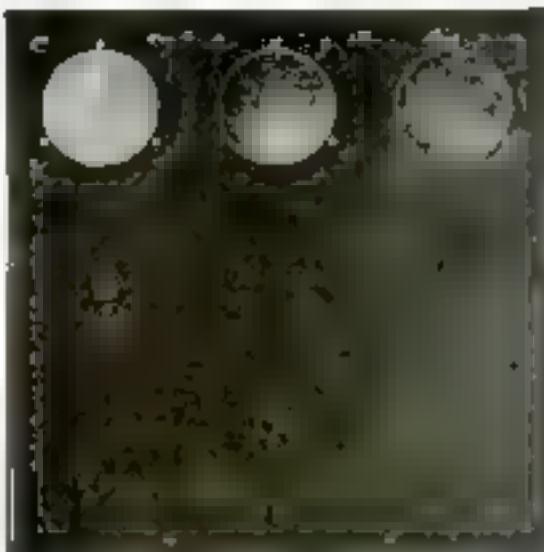
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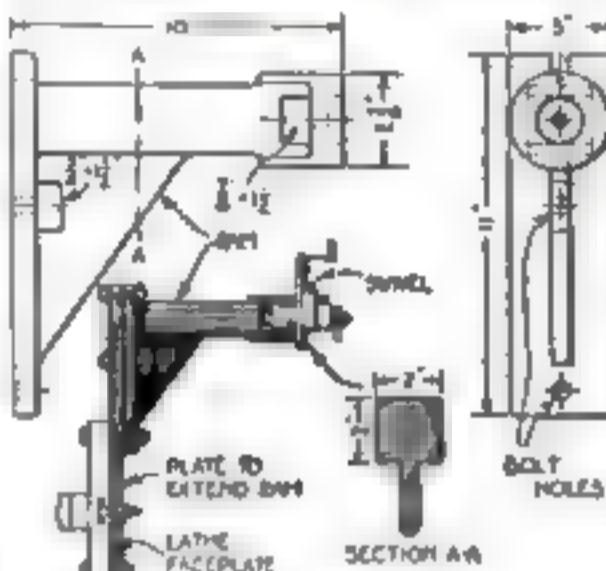
BETTER SHOP METHODS

Shaper and Planer Attachment

(Continued from page 82)

plate for two No. 1 taper pins, also provided with nuts with which they can be withdrawn. It will then always be possible to locate the angle plate readily when resetting it.

To avoid the necessity for the special patterns and core boxes required in making the castings, an alternative design for the ram is given. For machine shops or tool rooms where no facilities are available for



This ram may be constructed without castings, one slide only being used.

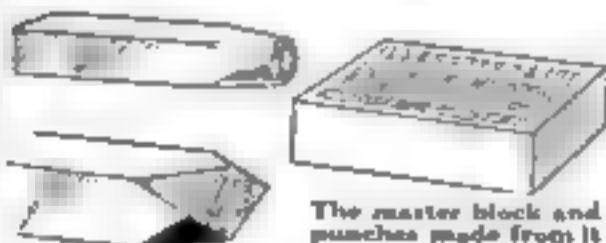
having the castings made easily, this construction, making use of machine steel, is recommended. It has one other point in its favor in that the steel will not crystallize as castings are apt to do, and will stand up better under excessive strains or abuse.

Additional range for the tool can be obtained by means of an extra plate bolted to the faceplate, as shown.

Another simplification that can be made at the option of the builder is to have only one slide on the ram. This does not reduce the capacity and flexibility of the attachment very much, but eliminates a lot of work in making it.

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The master block and punches made from it

as marks are made in this block as it is desired to keep. The block is then hardened or tempered.

At any time it is desired to make duplicates, a suitable piece of bar stock or other steel for the stencil, is driven, when soft, into the proper depression in the block. This makes a clean profile and only a small amount of relief work is required to finish the stamp, after which it is tempered in the usual way.—M. B. K.

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Keeping Up to the Minute on Shop Methods

WHILE going through a large, old plant I was deeply interested in the following development. In it was a young man seated at a table before a pile of magazines, well making vigorous use of a set of shears, a roll of adhesive paper,



Useful material to mark and to catch the eye around site

and a box of wax crayons. While I was watching him, he came to an article in a technical magazine on the pouring of metals, a subject of concern in the foundry where I worked. He stopped and looked at me X at the top of it was stuck to the page so that it protruded at the top of the magazine. This was a common mark of the foundry superintendent to it. Each department was responsible for its own X.

The power of the news on the part
executive should spend an hour or a
week in the reading room so as to learn
appreciate being able to select material of
interest to them without taking the time to
look through all the different kinds of

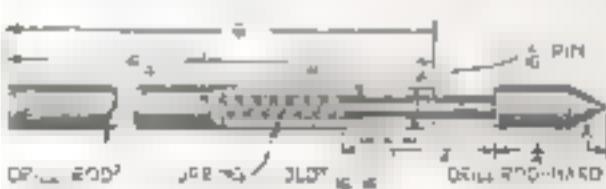
Jig for Cotter-Pin Holes Has Adjustable Stop



Making a Center Tester for Tool and Die Work

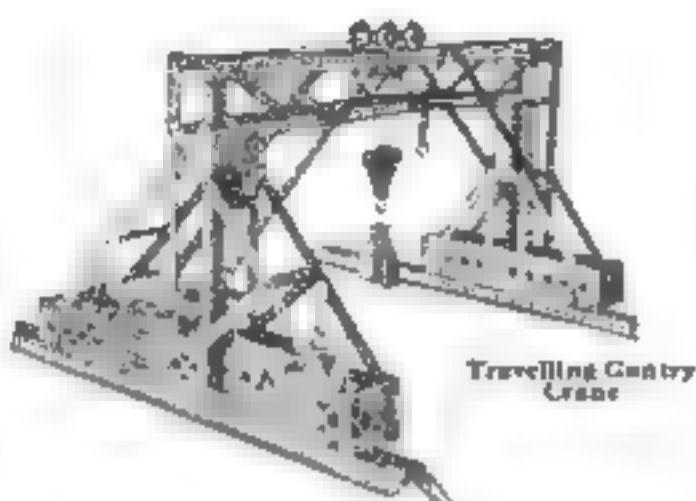
THIS center trater is one I made for myself and use right along on tool and die work in the shop.

The dimensions given may not suit every mechanic, but they can, of course, be

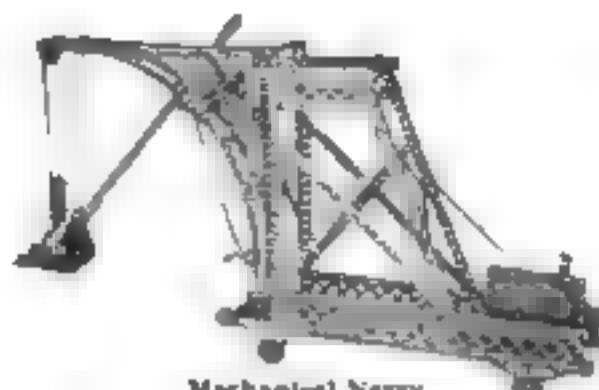


Details of the tester, the dimensions of which may be varied as desired

varied to suit the individual judgment. On fine work an indicator may be used with the tester — H. BENG



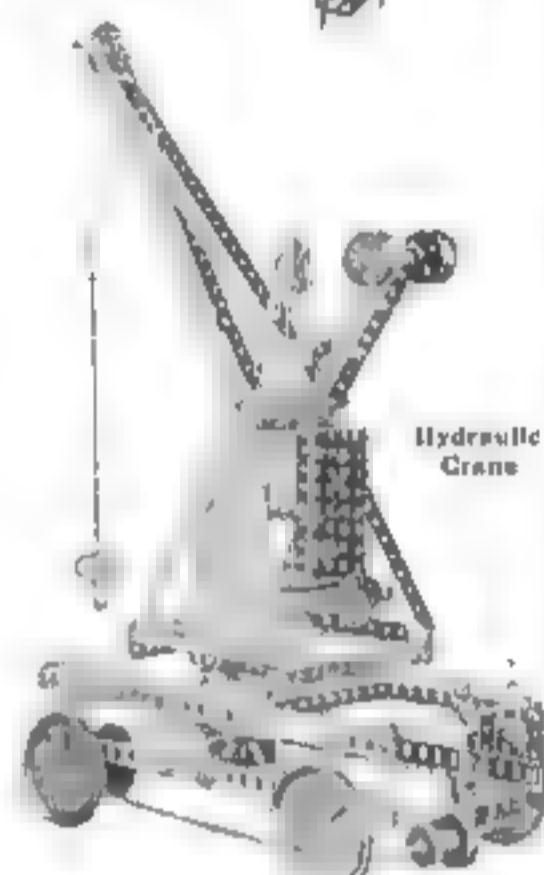
Travelling Gantry Crane



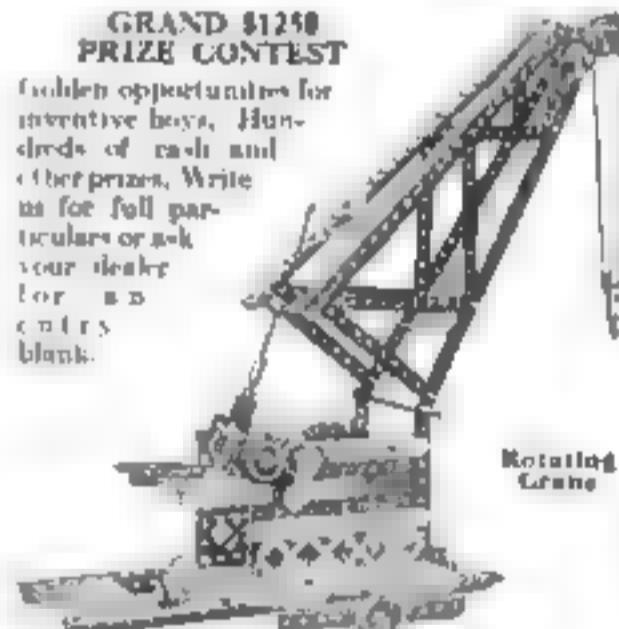
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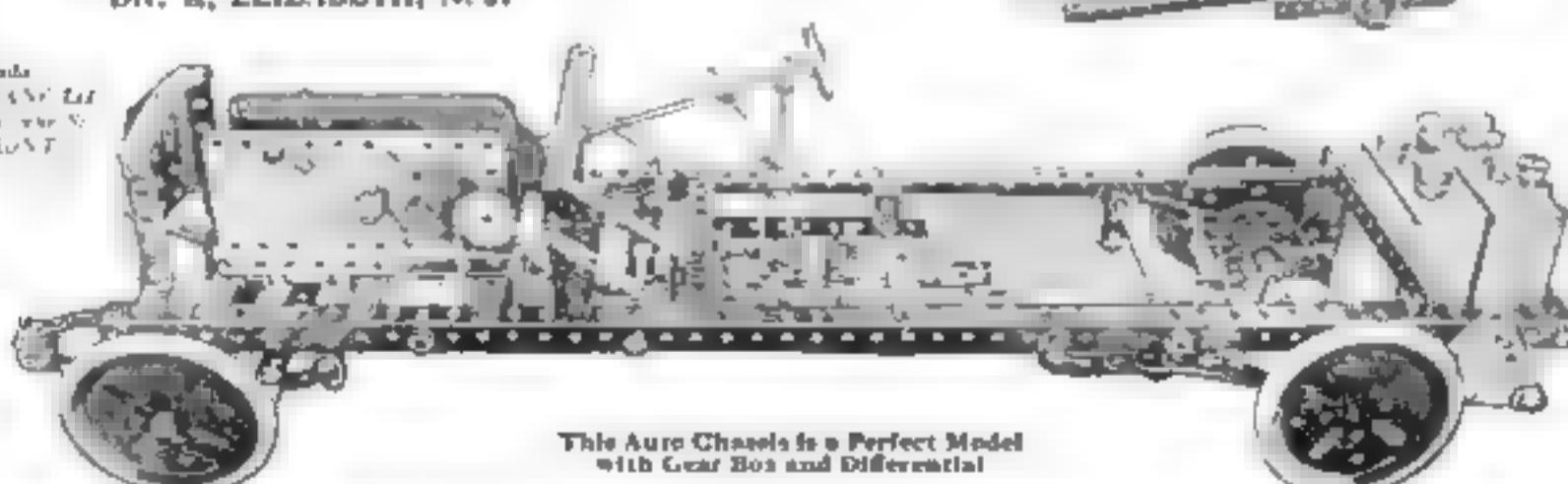
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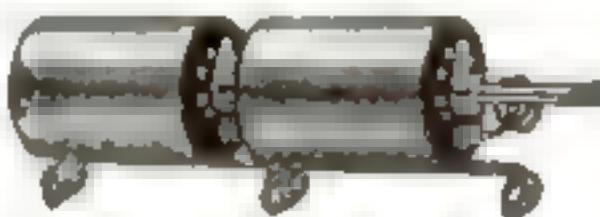
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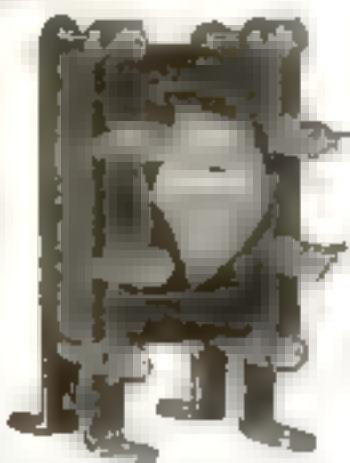


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Free Connection Diagrams

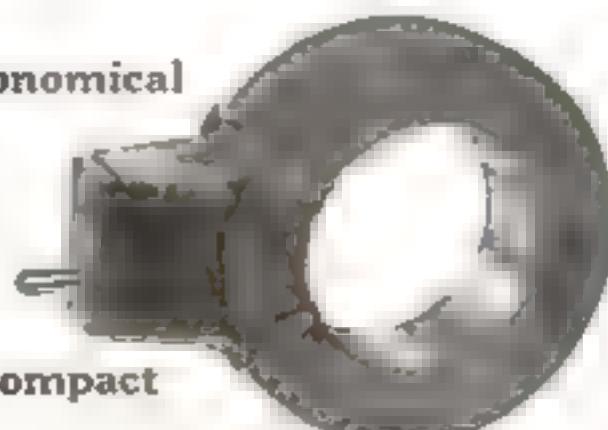
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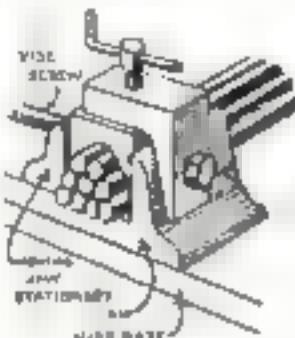
Compact

BETTER SHOP METHODS

Holding Nine Pieces Instead of One in Hacksaw Vice

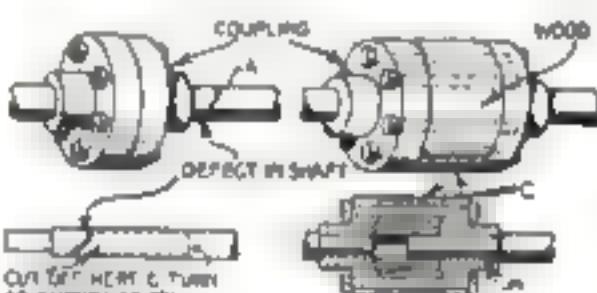
WE HAD considerable 1 15/16-in. cold rolled steel bars to saw into lengths on the power hacksaw, and in the beginning put only one piece at a time in the machine vise. This meant we were almost continually opening and closing the vise and had to keep a man on this job alone.

A better plan was quickly devised. We placed nine pieces as shown and made a little block that fitted over the shafts and could slide on them. To the stationary jaw of the vise we screwed a strap that in turn held a screw with a handle, used for locking all nine pieces at one time. This speeded up the work and relieved one man for another job, as he attended to the hacksaw only in his spare time.—J. H. MOORE.



Replacing a Defective Shaft

A SHAFT connected with an ordinary shaft coupling was found to have a fracture, as illustrated at A. We had to make a speedy repair in order to keep the machinery running, so we removed one



half of the coupling and cut off the defective part of the shaft.

Then we turned down the end of the good shaft, as shown at B, and cut a round piece of good tough oak to the shape shown at C.

This was placed over the turned-down end of the shaft with the half coupling.

Bolting the coupling together, we were ready to start the machinery again, for the oak block was the right size to make up for the length of shafting cut off. The view at C shows the shaft assembled.—H. J.

Chiseling Off Rivet Heads

TO PREVENT elongating rivet holes in thin metal plates when rivets are removed, it is well to back up each rivet with a crowbar while it is being cut off with a

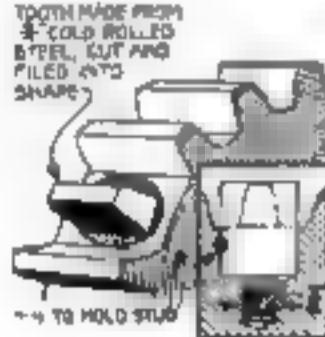


A method that prevents distortion of holes

cold chisel. The crowbar relieves the pressure of the rivets against the plates, and there is then no necessity for redrilling the holes when the plates are reassembled. If necessary, grind the point of the crowbar so that it will hold without slipping at the base of the rivet head.—G. L.

BETTER SHOP METHODS**Key Pins New Teeth in Place on Broken Gear**

IN THIS method of repairing broken teeth in a gear or on the rim of an automobile flywheel, a stud made of cold rolled steel is first inserted, as shown. The diameter of the head of the stud should be nearly the width of the other teeth. The threaded end should be about one half that diameter.

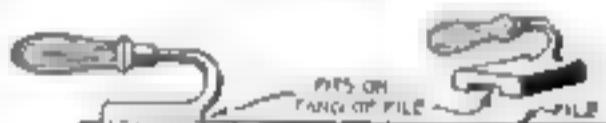


The flywheel is then drilled, counter-bored, and tapped to suit the stud, which is screwed in place and locked by means of a pin driven into a hole that is half in the rim and half in the stud. The face and flank of the teeth are then roughed out with a backsaw and finished by filing. A template of tin can be cut out to fit one of the other teeth exactly and then used as a guide in perfecting the shape of the new tooth.

This repair is particularly useful in replacing one or more teeth on the starting gear of an auto engine flywheel.—J. H. T.

Filing Awkward Shaped Pieces

HAVE you ever tried to file an awkward shaped piece or part that came almost level with the top of the vise? If you have, then, no doubt, you bruised your knuckles.



This handle saves knuckles from being bruised

Just as the writer did until he made the little file holder illustrated.

A groove is made to fit snugly over the tang of the file, and the handle, being above the level of the file, allows you to work without danger of bumping your knuckles. This is a stunt worth trying if you have much filing to do.—J. F. H.

Drilling Cement and Brick

AHANDY tool for drilling holes in brick walls, which the writer has found more effective than the old-fashioned star brick drill, is made by shaping one end of a piece of octagon steel of the desired size and length to a fish-tail bit. Point the other end to fit the chuck of an ordinary brace, and then temper the tool.

Instrument men will find this a help in plugging brick walls for mounting telephones, or drilling through walls when laying cables.—EVERETT IDLER



New files should be reserved for finishing the larger surfaces of cast iron, bronze, or brass. When the file has worn somewhat, it can be used upon the narrow surfaces of these metals and upon wrought iron and soft steel. A used file is better than a new one for the latter class of work, because it is not so apt to tear the surface.—H. L. D.



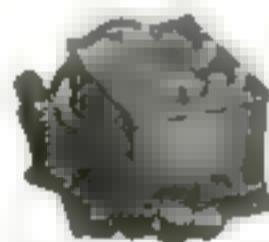
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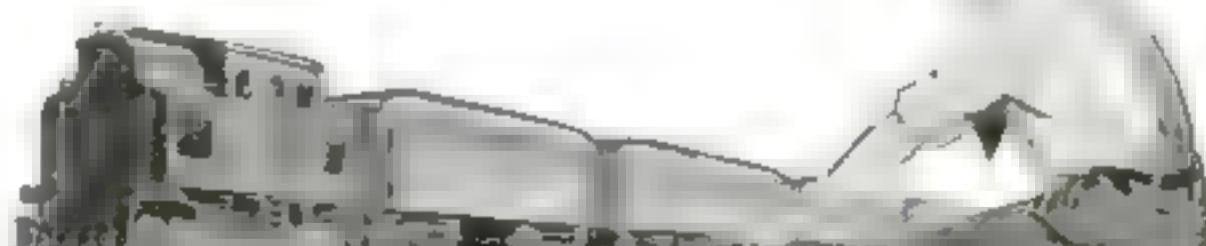
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The Home Workshop

Make a Tea Wagon at Half Store Prices

relieve the otherwise straight lines. A plain top is screwed on from underneath and the usual wheels and casters are added. Two tray handles are fastened to the top to take the place of a larger wooden handle. The completed wagon is painted or enamored in cream, light green, or some other appropriate light color, and stencil decorations are applied at the corners, and, if desired, at the center and along the upper rails. This design harmonizes well with some of the more modern painted dining-room furniture.

Number 4 is a design with turned legs, having an inclosed shelf directly beneath the top, upon which the tray can be placed when not in use. The tray is a trifle smaller than the top of the tea wagon. The leaves in this case, as in No. 2, are semicircular.

The mahogany tea wagon with a simple inlay on the rails and legs illustrated at No. 5, is unusual because the legs are set on an angle and no casters are provided for the longer ones. The wheels are extra large; they should be 18 in. in diameter, if possible, and very light in construction and design. The tray is a trifle smaller than the table top.

Number 6 is another unusual design, rather ornate in appearance, but not difficult to make, since both the legs and the large wheels are cut out with a band-saw, or fret-saw.

The reed tea wagon, shown at 7, is a type now much in favor. It is comparatively inexpensive and not at all difficult to make. A frame 16 in. wide, 24 in. long, and 30 in. high can be made as a foundation for the reed, or one already bored for the binding can be purchased from dealers in basketry supplies. Besides

(Continued from page 78)

the wooden frame, the supplies necessary are 1 lb. of No. 4 reed for braiding the edges of the frame and $\frac{1}{2}$ lb. of No. 8 reed for weaving the tray base, as well as glass for the tray, and if desired, for the lower shelf.

Another simple type of tea wagon without leaves or turned legs is shown in No. 8. The omission of the leaves makes it possible to provide a roomy silver drawer. In tea wagons with leaves a small drawer is often provided, and sometimes there is a drawer in both ends. The tray handles in this case are made of wood in a style much favored by some furniture designers and craftsmen.

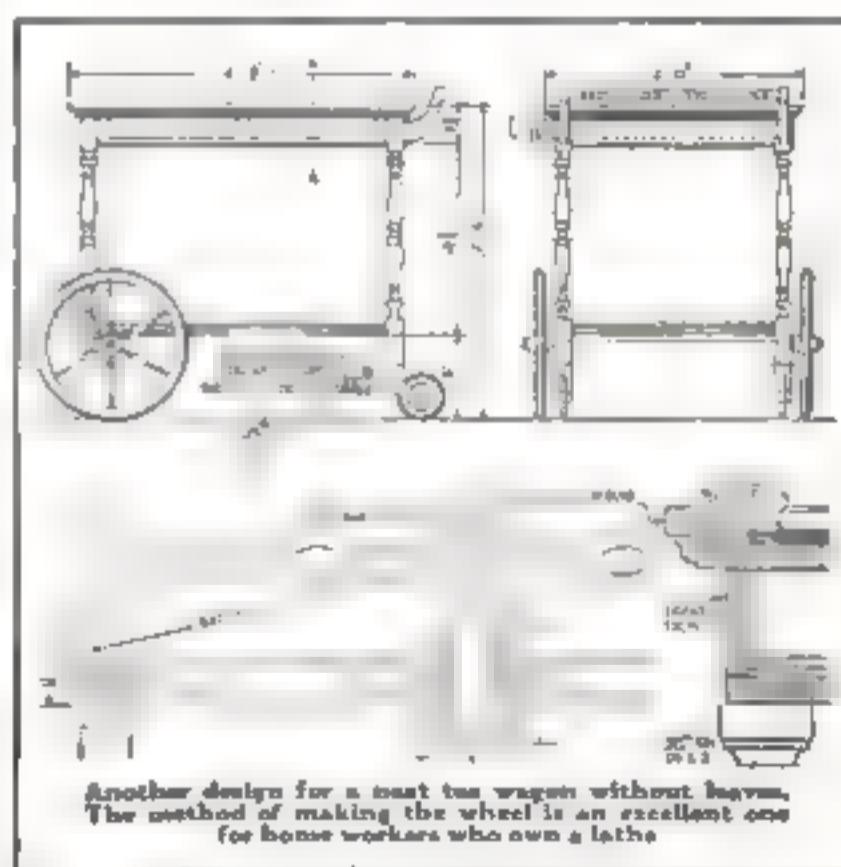
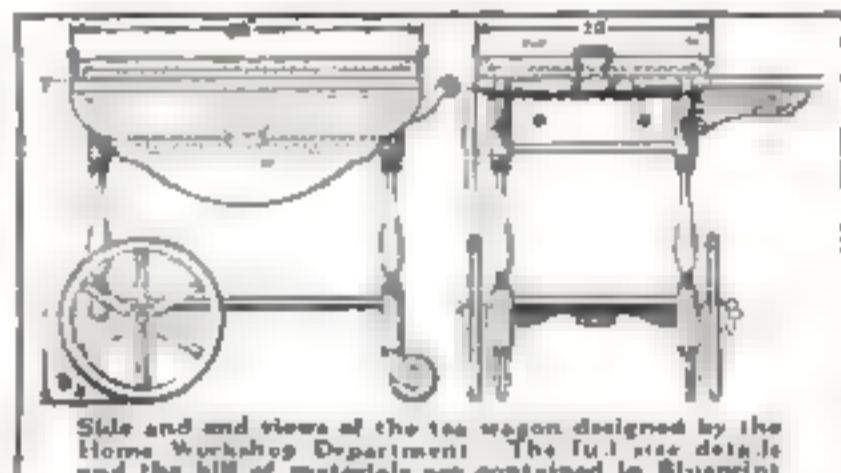
Number 10 is an electrified tea wagon, fitted with a double outlet for attaching an electric coffee urn, chafing dish, toaster, or stove. A length of lamp cord plugged in underneath the tea wagon runs to a base-board outlet or the nearest available light socket.

The majority of tea wagons have turned legs and these and any other turnings required, such as handles, can readily be obtained by any one who has access to a lathe or cares to go to the moderate expense of having the work done by a woodturner.

If you have your own lathe, you can make even the wheels, which provide a particularly interesting problem in wood turning.

In place of special turnings, stair balusters can be used. If they are old fashioned ones, they may have more or less individuality in design and serve fairly well as legs, but modern mill-made balusters are often spindly and inappropriate for furniture.

The legs do not, however, have to be



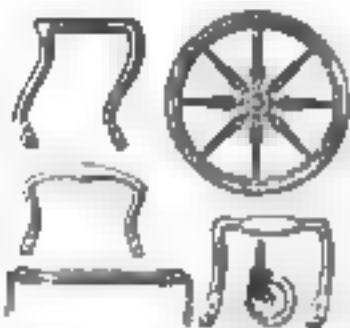
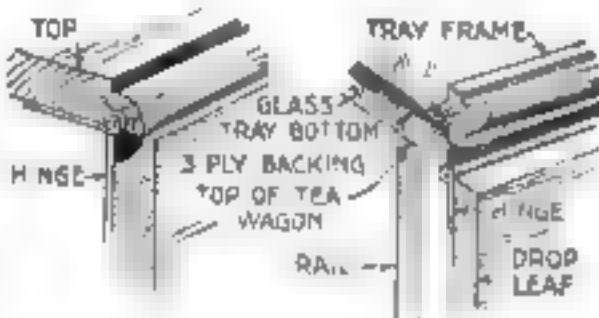
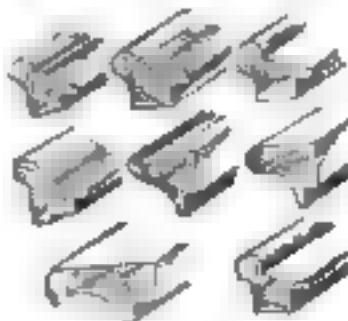
THE HOME WORKSHOP

How to Make a Tea Wagon

(Continued from page 90)

turned. They can be plain and straight, or have the edges slightly rounded or chamfered, or they can be made with decorative edges and "voids" in fret-saw fashion.

Tea wagon wheels can be purchased from dealers in manual training supplies and from some stores handling baby carriage wheels. Furniture stores often will obtain them on order. A wheel that is regarded more or less as standard is 10 in. in diameter with a $\frac{3}{4}$ in. rubber tire. The spokes are



turned ashown and have ornamental bats. The axles are usually about 17 $\frac{1}{2}$ in. between the hubs, but they can be cut in half and attached separately to accommodate the wider wagons. These wheels are usually made in mahogany, oak, or gum, the latter taking a good imitation mahogany finish. Baby carriage wheels can, of course, be substituted.

Casters can be obtained without difficulty. They usually have rubber tired wheels 3 in. in diameter and about $\frac{1}{2}$ in.

(Continued on page 92)

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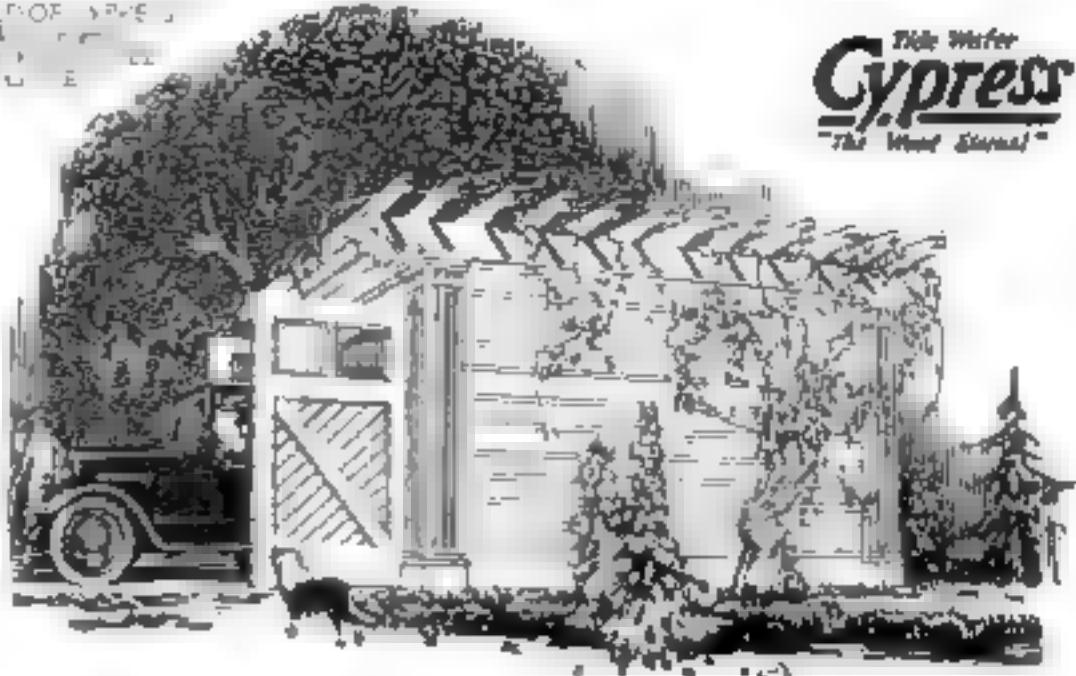
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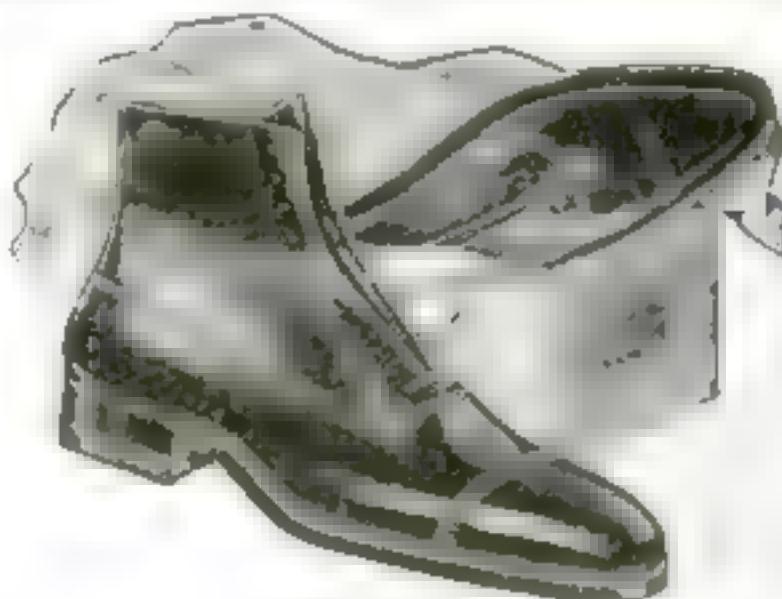


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Any ideas that have helped you in your own home workshop or aided you in repairing or improving your home are apt to be of value to other tool users and are possibly prize-winning material. If you will describe them briefly and send them to the Home Workshop Editor, POPULAR SCIENCE MONTHLY, 226 West 39th Street, New York, they may deserve one of the awards.

The articles should be accompanied either by photographs or pencil sketches to make clear the details of construction.

The prizes for November have been awarded as follows:

FIRST PRIZE, \$15: Paul H. Byer, Hagerstown, Md., for a description and the working details of an automatic heat regulator (see page 103).

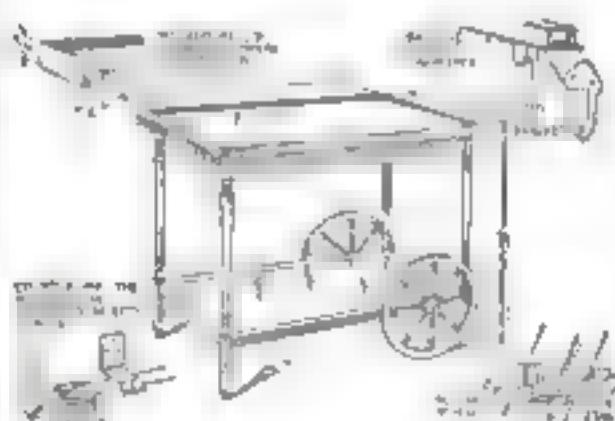
SECOND PRIZE, \$10: John A. Mahan, Baltimore, Md., "Auto and Phonograph Horns Combined to Make Loud Speaker" (see page 122).

How to Make a Tea Wagon

Continued from page 91

thick. Some are solid and others have small spokes. Ordinary easers will serve the purpose, but are not as neat.

Although wooden handles are frequently used on the trays, metal tray handles are sold in many varieties of shapes, sizes, and finishes. Some tea wagons with drop leaves have a tray handle in place of the conventional turned wooden handle, and there is a certain advantage in this because



Oak tea wagon made by Frank W. Sheltie, of Lansing, Mich. Top, which is hinged, covers silver compartment. Table leaf hinges with extra holes are used so that top will stand open. Handle is supported by brass hand-call brackets.

the smaller tray handle is not so much in the way when the tea wagon is being used as a luncheon table. A craftsmanlike way of providing handles is to make them of hammered brass or copper.

The regular large wooden handle can be disposed of when the wagon is used as a table if some simple arrangement is made to swing it below the end rail.

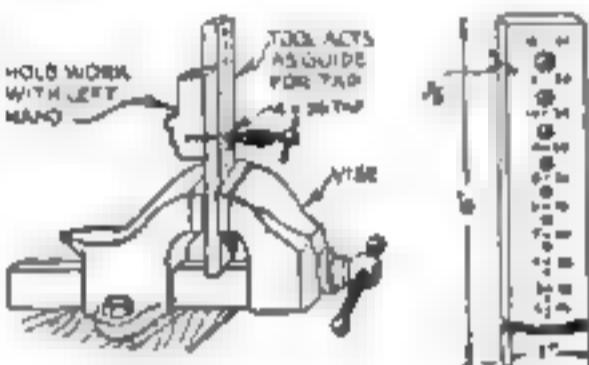
Tray moldings are made in a wide variety of styles and can be obtained easily

THE HOME WORKSHOP

Drill Block Prevents Breakage of Small Hand Taps

TO TAP a small hole in a piece of metal held in a vise without breaking the tap or cutting the thread out of square requires much skill and care. When the tap reaches the bottom of the hole, the resistance is hardly felt and yet the smallest fraction of a turn often breaks the tap.

This difficulty can be eliminated if a piece of cold rolled steel $\frac{1}{8}$ or $\frac{3}{16}$ by $\frac{1}{4}$ by 6

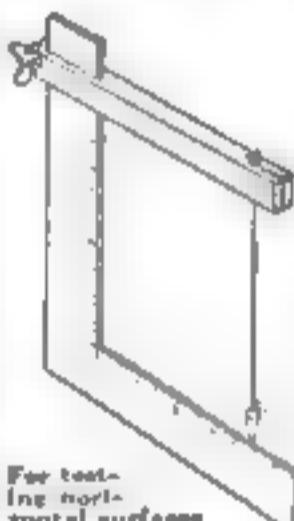


The tap guide and how it is used

in. has a number of holes drilled through it to suit the different sizes of taps ordinarily used. The piece is held vertically in the vise and the tap is placed in the proper hole. The work to be tapped is held in the left hand against the flat side of the fixture and tapped in the usual way. It will be tapped perfectly true and as soon as the tap reaches the bottom of the hole the strain will be felt before there is any danger of the tap's breaking.—ARTHUR E. SCHOLE.

Steel Square and Plumb Bob Form Serviceable Level

A SERVICEABLE and unbreakable level can be made with a steel square, a plumb bob, and a piece of hardwood. Saw a long notch in one end of the stick and a short notch in the other end and bore a hole through at the long notch. Insert a bolt with a wingnut to clamp the bar to the square, as shown. The device can then be used in place of a spirit level on horizontal surfaces by observing the deflection of the plumb bob in relation to the scale.—J. G.

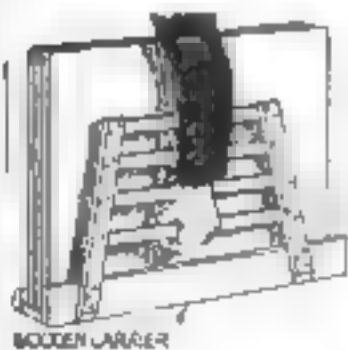


For testing horizontal surfaces

Carrying Large Sheets of Glass, Veneer, or Cardboard

TO CARRY sheets of glass, veneer, cardboard, and other flat, unwieldy objects, make a light-weight wooden rack as shown. A series of cross pieces afford a choice of hand grips; they make it unnecessary to strain the arm down to the bottom of the sheets.

Strips of felt may be glued to the parts of the rack that come in contact with the glass. —C. NYE.



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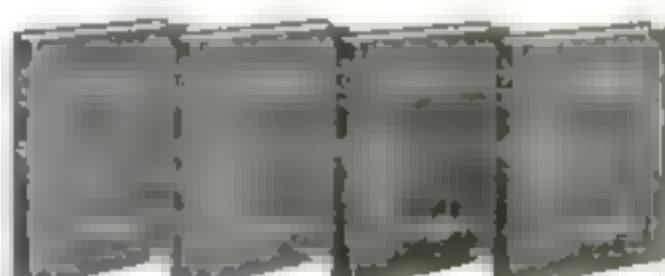
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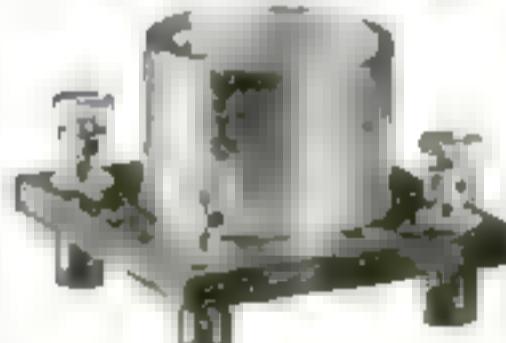
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Aerial Yachtsmen

(Continued from page 27)

The longer the duration of the gust, the better.

During the period of increasing wind velocity, a pilot should turn his machine head on to the wind and should steadily gain height. In the second period, he should turn at right angles to the wind, the machine usually loses some height during this period. At the beginning of the third period of decreasing wind speed, the machine should be turned tail to the wind. Since its speed is relatively greater than that of the wind at diminishing velocity, it is possible for the machine to gain height. During the period of minimum speed the pilot should again turn at right angles to the wind.

Compare this thrilling method of flight, in which the air offers a constant challenge to the pilot's ingenuity and resourcefulness, and in which he must depend for his motive power solely on his skill in "outguessing the winds" with the power plane flights in the recent Pulitzer contests at Detroit, Mich., in which the pilots, by merely watching dials and pulling levers, had instant command over power, speed, and direction. Such a comparison reveals the challenging nature of the fascinating new sport of air sailing.

Qualities an Air Pilot Needs

The most necessary qualities for a pilot in soaring flight are knowledge of the structure of the wing and ability to recognize in advance the nature of gusts. This quality might be called "seeing the air." Some airplane pilots fight the air; others ride it. The pilot of the plane in which I flew as passenger from New York to Omaha in October, 1921, used the air gusts to gain altitude and would catch the gusts under the wings and let them buoy up the machine for several hundred feet at a time. He followed the trends of wind instead of fighting them as some fliers do. A motor machine flies best in still air or with favoring winds. A sailplane must have gusty and strong winds, and its pilot must "see" what to do with them, just ahead of time.

A gust of wind is in reality a wave of air. If you learn how to keep your sailplane in the front side of a high wave, you will glide downhill for miles, just as a canoe with a wave at its stern will be carried along a river. But waves of air are not always what they seem. Sometimes, while there is a blanket of still air just over the earth's surface, swift air currents move above the calm. I have been in a balloon the bag of which was being carried along by one of these upper currents so swiftly that from the car beneath it seemed as if a strong wind were blowing against our faces, yet in reality the car was moving in the layer of still air.

How the Birds Do It

Experiments show that birds seem to "feel" their way through the air and to sense strength and direction of the wind. This may lead to the invention of sensitive anemometers combined with wind vanes, mounted on antennae, or of "feelers" projecting far in front of the machine of the future, to warn the pilot of the direction and relative strength of wind gusts.

Although the pilot is all important in air sailing, the machine, of course, must be very responsive to control, with sensitive rudders, elevators, and ailerons.

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A photograph showing the
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Radio Broadcast. See coils
and the magnet.

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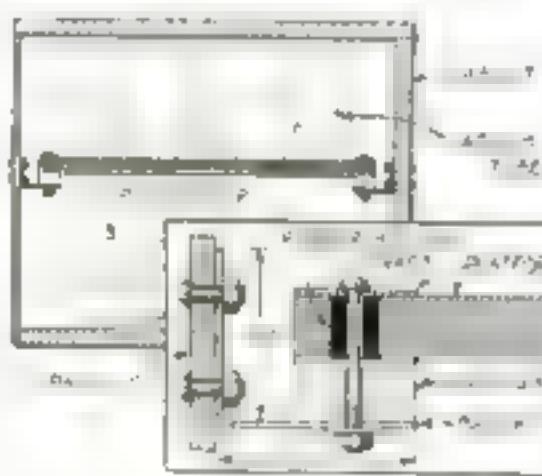
Next month we
will tell you more
about the "heart of
the Manhattan
Headset."

THE HOME WORKSHOP

Brackets Support Vacuum Tube Platform in Radio Cabinet

A NEAT and inexpensive method of mounting a platform for vacuum tubes in a radio cabinet is to support it from brackets on the panel and the back of the cabinet, as illustrated. This has an advantage over the usual U-shaped support because of the ease with which soldered connections may be made between rheostats and other parts below the platform that often are difficult to get at.

With this design the entire under side of the platform is free and it may be adjusted



This mounting leaves space above under tube platform and makes it easier to solder connections

to any height to suit the transformers used, if they are to be placed in the usual position under the tubes. Cushions of soft rubber are placed between the brackets and the platform, which is insulated entirely from the retaining screws by means of rubber bushings and straps made of fiber, hard rubber, or composition.

When the mounting has been prepared, the platform can be removed while the vacuum tube sockets are fixed to it, and then the whole replaced as a unit. If the transformers are attached to the under side of it, the soldering of the connections between tubes and transformers also can be done before finally fastening the platform in place.—CHARLES F. LANOLLETTE.

Nail Forms Handle for Cork

CORKS in varnish cans and other containers often fit flush and are very difficult to remove. This is particularly annoying when small quantities of the liquid contained in the can are required at frequent intervals.

One of the simplest methods of providing a handle for the drawing of such corks is to drive a wire nail through the cork from the under side and bend the point at an angle to give a finger grip.—J. M. PITT.

Removing Rust from Nickel Plate

RUST spots on nickel surfaces may be removed by rubbing the parts thoroughly with hard oil or vaseline. Allow oil to remain for several days if possible; then wipe clean with a cloth soaked in ammonia. If the spots do not yield to this treatment, add several drops of hydrochloric acid to the ammonia. After applying the solution, dry at once, then rinse with water, dry again, and polish.—DALE R. VAN HOEN.

**Unequalled Low-Priced Offers**

The Master-Baldwin "Throat-type" Clarophone, complete . . . \$22.50
Described below

The Master-Baldwin Head Phone \$ 9.00
The new and improved Baldwin Phone, is sufficient for all except radio work. One does the work of two ordinary phones.

The Baldwin Head-Set \$16.00
The standard super-sensitive head-set for those who want the double phone.

This Amazing Radio Feature

means radio enjoyment for the entire family
at a price within the reach of all

YOU who know radio equipment know the Baldwin Phone. You know its war record.

The Government commandeered the Baldwin factory during the war to assure Baldwin Head-sets for War Volutines and Army and Government Stations.

Where exacting work is done there you find Baldwin.

Now this amazing phone is available to the public in the Master-Baldwin "Throat-type" Clarophone, the newest and most perfect speaker

A Clearspeaker

The Master-Baldwin is not a so-called "loud" but rather a clearspeaker, which enables a number of people to hear every word of note.

—hear perfectly every sound, every vibration, even the harmonics. Not snapping, buzzing, breaking or any noise save those caused by your receiving set.

—bear clearly and distinctly throughout the average size room any broadcasting that your set will pick up.

No changing of a head-set from one to another. No one misses part of the program.

Now you can really enjoy radio with the Master-Baldwin "Throat-type" Clarophone.

Two Secrets of Its Perfection

One secret of this instrument is a marvelous voice disk, unaffected by heat, cold or electric currents, which is actuated in both directions by an armature tone-arm superimposed in a magnetic field.

The other is a specially designed speaker which follows almost exactly the shape of Caruso's throat.

And its rectangular mouth follows the principle which opera singers know and use to get full resonance from the roof of the mouth.

So the Master-Baldwin "Throat-type" Clarophone follows scientifically a perfect model.

It gives you the best from your receiving set.

\$22.50—An Amazing Price

The wonderful Clarophone costs but \$22.50, complete. So everyone may have one.

Simplicity of design and large scale production account for this revolutionary price on an instrument which is the highest quality the world affords.

Try It at Our Risk

We make you the judge. Test it 10 days. Attach it to your set. Compare with others. We know you will be delighted.

If not pleased, return it to your dealer and get your money back.

Ask your dealer for the Master-Baldwin "Throat-type" Clarophone.

If he hasn't it order from us. Including \$22.50. We'll ship your Clarophone immediately, charges prepaid. (Reference: Citizens National Bank, Los Angeles, Calif.)

Know the real joys of radio. Get this necessary equipment at once.

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Dept. 801, 625 Spring St.,
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Master-Baldwin "Throat-type" Clarophone

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Los Angeles, California.

Enclosed is \$22.50 for one Master-Baldwin "Throat-type" Clarophone, charges prepaid. My money will be refunded if I return the instrument within 10 days to you. In case I am not satisfied

I buy my radio equipment from

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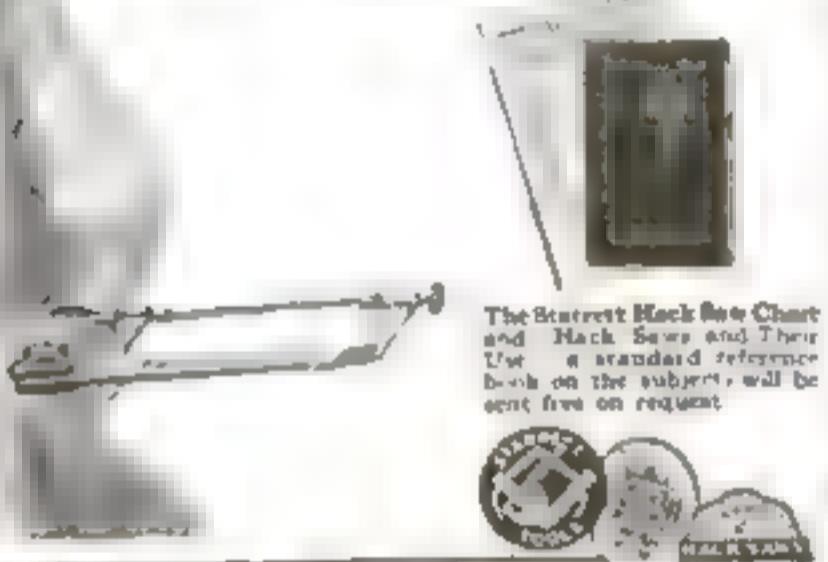
Balances in your hand as naturally as a Colt 45

Here's an "eye-opener" for the man who has always used the old style frame. A well designed, substantially built hack saw frame has a perfect "hang"—takes any length of blade from 8 to 12 inches and can be set to cut in four directions without removing the wing-nut. A constant tension on the bolts holding the blade and a positive adjustment on the tubular back saves countless words and much valuable time when changing blades. Hard rubber checked handle and stream line design. A Hack Saw Frame you will always swear by—never let go. Ask for Starrett Pistol Grip Adjustable Hack Saw Frame No. 149. You can get it at almost any hardware store.

Write for Catalog No. 22 "W" and the Supplement describing the new Starrett Tools.

THE L. S. STARRETT CO.

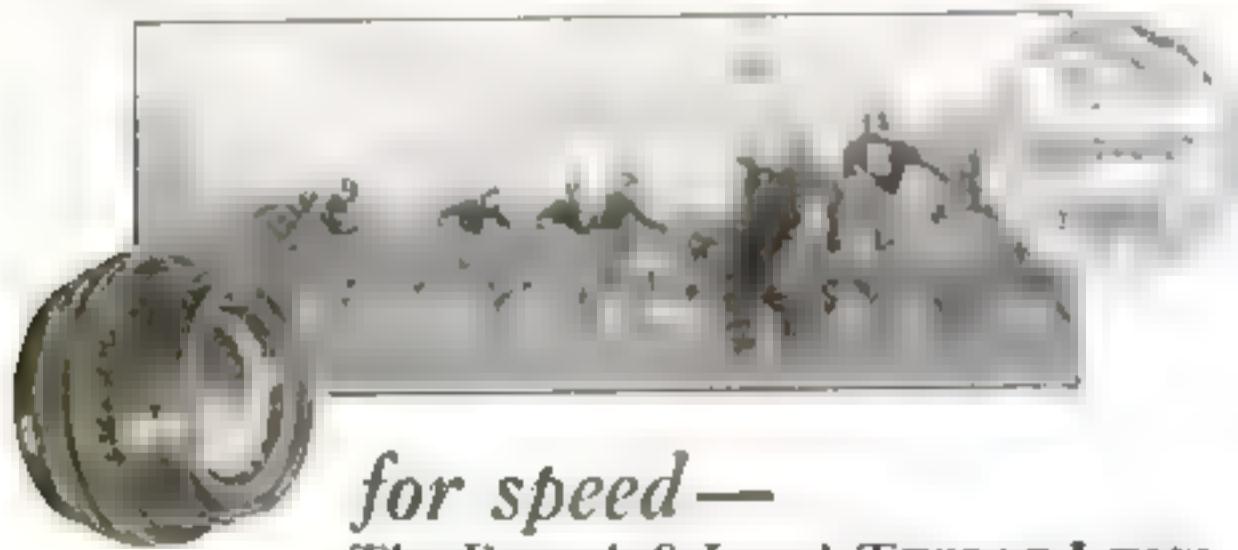
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.



The Starrett Hack Saw Chart
and Hack Saws and Their Use—a standard reference
book on the subject, will be
sent free on request.



Use Starrett Tools



for speed—

The Bausch & Lomb TESSAR LENS

FAST though the half-back may be, the Bausch & Lomb Tessar gets him on the run, clearly and sharply, not blurred. For speed work the Tessar is unsurpassed. And on cloudy days or indoors, it makes possible snapshots where o-

dinary lenses require time exposure.

Made by America's greatest optical house, the Bausch & Lomb Tessar is unsurpassed by any other anastigmat lens in the world.

Tessar is the lens for both amateur and professional.

Write for booklet, "What Lens Shall I Buy?" describing our complete line of anastigmat lenses.

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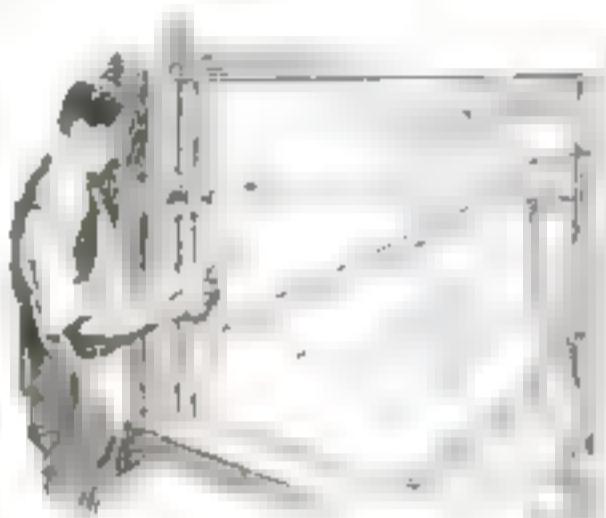
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Leading American makers of Stereo-Prism Binoculars, Telescopes, Photographic Lenses, Projector Apparatus (Kinematograph), Microscopes, Magnifiers, Automobile Lenses and other High-Grade Optical Products.

THE HOME WORKSHOP

Antenna, for Use in Towns, Attaches to Clothes Line

RADIO fans who live in upper apartments or flats where old-fashioned pulley clothes lines are used, can install an aerial with very little difficulty. The first step is to obtain a large, empty wooden reel and make a bracket for it, so that it can be fastened to the window or back porch near the clothes line. Fasten an eye and about 6 in. of strong cord or light rope to the reel. Tie an insulator to the end of the cord and



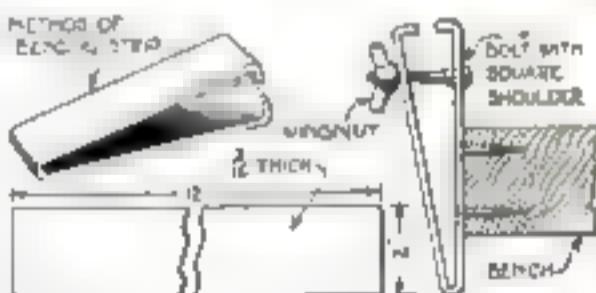
Since this antenna is withdrawn when not in use, there is no lightning hazard nor possibility of static discharges when the set is first connected.

connect with the insulator the wire, allowing a short end sufficient to serve as a lead-in.

At the farther end of the aerial wire place another insulator, 6 in. more of cord, and a third insulator, which is to serve as a stop when it comes in contact with the pulley on the clothes-line pole. To erect the aerial, it is merely necessary to attach this last insulator to the clothes line and pull it out as far as it will go. The antenna can be quickly withdrawn when it is no longer needed.—P. A. DAWHURK.

Light Bench Clamp Useful in Holding Radio Parts

SMALL work on radio apparatus and electrical instruments often can readily be handled in a bench clamp made as shown, from materials to be found in most scrap boxes. The body of the clamp is a piece of flat steel, about $\frac{1}{8}$ in. thick, 2 in. wide, and 12 in. long. The ends are bent in to form the jaws and the center of the



A handy vise for small metalwork

strip is turned sharply to bring the ends within 1 in. of each other.

Countersunk holes on one side are provided for the screws with which vise is fastened to bench. A stovebolt passes through holes drilled in the sides of the body opposite each other and a wingnut serves for setting the jaws on the part to be held. The elasticity of the steel opens the jaws when the work is to be removed.—G. A. LUERS.

Germs from Other Worlds

(Continued from page 41)

similar to our own has been very lately disputed, as a result of remarkable observations at the observatory on Mount Wilson, Calif., where spectroscopic studies are said to have revealed no trace of water vapor or oxygen around the planet. On the other hand, some observers advance evidence to prove that there are heavy clouds hanging about Venus, and that her temperature is comparable to Earth's.

So the scientific debate stands to-day and meanwhile, the possibility of radio communication with the other planets provided there are indeed living beings upon them, has made this whole discussion one of the greatest popular interest, while the discussion itself has aroused an intense renewed interest in the original theory of Arrhenius as to the spread of life spores throughout the universe by light rays.

Space is, according to Arrhenius, filled with shoals of living "seeds," and occasionally spores of bacteria, which settle upon Earth and other planets and commence life in those worlds where conditions are suitable.

Sunlight Composed of Light Corpuscles

This theory is strengthened by the belief that sunlight is composed of minute "light corpuscles"—bits of matter that are being incessantly radiated from the Sun. That side of Earth turned toward the Sun is being continually bombarded by untold billions of these light corpuscles. Though in size extremely minute, yet they are numerous enough to exert a "push" upon our globe, in opposition to solar gravitation, equivalent to 75,000 tons.

Many of the particles of dust occupying interplanetary space are smaller than the light corpuscles in question. These dust particles are, moreover, charged with life germs. When light corpuscles from the Sun hit these dust particles that are smaller than themselves, they push them along through space, and by chance may transport them to Earth and other planets.

This force of light, known as light pressure, is powerful enough to detach a living organism from Earth's atmosphere, or that of some other planet, push it out into space, and finally transplant it upon the soil of another world. Twenty days would be required for organisms to traverse the distance separating us from Venus or Mars.

What Arrhenius Believes

Professor Arrhenius considers that while many of the seeds and spores, during their celestial journey, will be killed, occasionally they will retain their vitality and settle upon fertile ground, creating life in worlds that have cooled down sufficiently to form a suitable abode. From this we might infer that all life, from one end of the universe to the other, bears an intimate relationship, and that the higher beings evolved from it and perhaps residing—in some still believe possible—on Venus or Mars, may not, after all, be so greatly dissimilar from ourselves as most imaginary drawings of the "Martians" have pictured them.

If the Sun's light pressure is capable of transplanting tiny life germs from planet to planet, it might more easily transport the spores of bacteria, since they are still smaller. The planet Venus, our sister world, is, Professor Arrhenius thinks, probably a suitable abode for the lower

(Continued on page 99)

GOODELL-PRATT

1500 GOOD TOOLS

"Accuracy is my family name," says Mr. Punch

You've got to buy measuring instruments and precision tools—micrometers, gauges, calipers and steel rules—largely on *faith*. The reputation of the maker is your best guarantee of accuracy.

The confidence and faith that mechanics, artisans, and other workmen have in the Goodell-Pratt 1500 Good Tools is never misplaced. Before you buy another steel rule, measure it up with a micrometer.

Exceptional accuracy—the result of taking pains

If you could see the infinite pains taken in the making of all Goodell-Pratt 1500 Good Tools—you would realize why so many thousands of workmen have such *faith* and confidence in the Goodell-Pratt Tools they use.

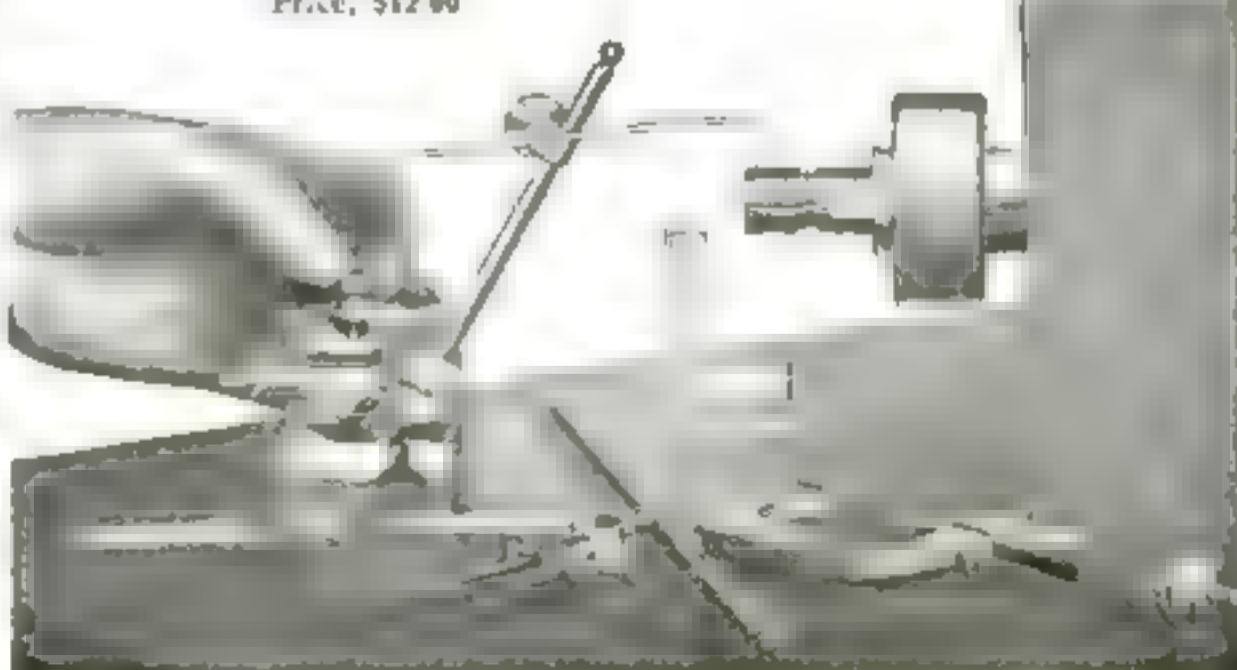
Your hardware dealer has Goodell-Pratt Tools or can get them for you. Talk to him. Meantime, write for a copy of our new machinist tool catalog picturing and describing the very tools you have always wanted to call your own. It's free.

GOODELL-PRATT COMPANY

Toolsmiths

Greenfield, Mass.

Surface Gauge
No. 55
with Micrometer
Adjustment
Price, \$12.00



They Wouldn't Be The Same

Given the same tools and material, two different workmen would make two kinds of a house. The house of one would be well finished—its interior, decorations and grounds a pleasant sight to behold—the small details given attention—a house well made, finished and complete.

The other would build, but not so cleverly—you know the difference in two people. You would see the amateurishness in his work. His house would not serve as well or last as long as the house of the first builder.

So it is with Machinists' Tools. There is a difference in the way they are made, in the hardening and finishing of the steel, a superiority in design, a higher accuracy, cleaner graduations, here and there a slight advantage, which, all combined, make a superior Machinists' Tool.

BROWN & SHARPE MACHINISTS' TOOLS

represent the first builder's product. They were the first precision tools in America. Their superiority is shown by their fine finish, clean cut graduations, correct design, their world known accuracy and long life. Send for copy of our No. 48 Catalog, listing 2000 different tools.

BROWN & SHARPE MFG. CO.

Providence, R. I., U. S. A.

MONARCH JUNIOR LATHES

"The Biggest Little Lathe Built."

Accuracy - precision

Speed - power

Size - portability

Price - economy

Quality - dependability

Service - reliability

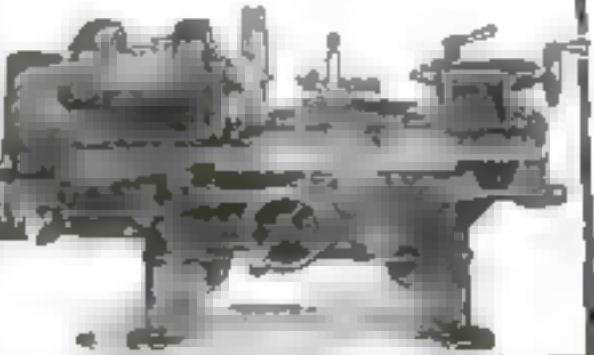
Monarch Junior Lathe

Stock Swing - 2 1/2
H. P. 1/2

\$225

See Quick Check
Circular Back
Page

The Monarch Machine Tool Co.
401 Oak Street, Sidney, Ohio



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INTERNATIONAL BODY WORKS, INC. 100 W. 45th St., New York, N. Y.

\$2 Brings This Genuine DIAMOND PLATINUM RING

SEND ONLY \$2.00 and



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Free Trial

FREE -
\$2,000.00
10 months to pay on
everything
ROYAL DIAMOND WATCH CO.
3537-39 Maiden Lane - New York

Plant Hunters Risk Lives

(Continued from page 29)

list valued at over \$6,000,000 by Arizona and California growers.

These are but a few of the many foreign crops and fruits that have been established in this country through the crop introduction activities of the Department of Agriculture. Prominent among other plant immigrants are Chinese dates, persimmons, edible bamboo, chayotes, Japanese udo, Egyptian and Algerian date palms, Indian mangos, yang zao trees, South and Central American avocados, Chinese strawberries, Colombian blackberries, wild peaches and almonds, wild alfalfas, dwarf almonds, cherries and apricots, fruited currants, Chinese pears, Chinese jasmines, tung-oil trees and pistachio trees.

In His Country's Service

The early service rendered by the Office of Foreign Plant and Seed Introduction of the United States Department of Agriculture owes much of its success to the enthusiasm of Mr. Barbour Lathrop of San Francisco. In addition to his individual work in discovering and introducing many foreign plants, nuts, and fruits into this country, Mr. Lathrop, in company with David Fairchild, now chief of the office, traveled at Mr. Lathrop's expense for three years through many countries, collecting new plants and laying the groundwork for future broad and constructive effort.

One of the first of the exploring scientists, Frank N. Meyer, finally lost his life in the service, after passing through experiences that would match the tales of a soldier of fortune. In the nine years spent in China, Siberia, Turkestan and Korea, he walked over 10,000 miles in search of agricultural gems. Alone and miles from help he fought off Chinese ruffians who sought to hinder his work. For from six to eight months he traveled through the wilderness without seeing another white man. During this time he gathered and transmitted to Washington thousands of plants that have enriched the fortunes of many farmers.

His invaluable work was suddenly terminated by his accidental drowning while en route home, but the memory of his achievements is kept fresh in the minds of other workers in the service by the "Frank N. Meyer Medal" awarded annually by the American Genetic Association for the most outstanding achievement in plant introduction work.

Some African Products

Dr. H. L. Shantz, another of the leading agricultural explorers, has invaded the innermost jungles of darkest Africa, on a 9000-mile trip, in many respects the most remarkable ever made by one of Uncle Sam's plant hunters. Personally, he has sent in 1600 specimens of various kinds of African fruits, nuts, sorghums, and other unusual horticultural products.

In Cape Colony Doctor Shantz obtained cuttings of the speckboom, a forage crop that gives evidences of adaptation to culture under Californian conditions; and he collected also many samples of forage and desert plants that thrive under African arid land conditions, and that may be of importance in vegetating our Western ranges. In East Africa he discovered and secured specimens of the famous teferaia nut tree, which bears large glands two or three feet long, containing a number of deliciously

(Continued on page 99)



"Red Devil" Rapid Boring Auger Bits
are 33 1/2% easier boring, have 10% greater clearance and bore with or against the grain of any wood.
Size 2400—10-16 in. shear bit 75c

Red Devil Lock Washers Do Stop Vibration!



LOOSENING, rattling, wear and tear put an end instantly and permanently.

Bolts and nuts on automobiles, trucks, tractors, stationary and marine engines, farm machinery, etc., hold and stay tight!

"Red Devil" Lock Washers are corrugated—have six points of contact where others have only two—three times the gripping power of others. It requires $1\frac{1}{4}$ turns to loosen them while others will loosen with a $\frac{1}{4}$ turn. That means 66% per cent. greater efficiency. Easy to apply.

In assorted sizes in handy bags, retailing as follows: 30 in a bag, 15c; 40 in a bag, 20c; 90 in a bag, 25c. At all good hardware stores. If dealer is out of stock, send name of dealer and order direct.

"Red Devil" Mechanics' Tool Booklet Free

"Red Devil" Tools
American made

SMITH & HEMENWAY CO., Inc.

Manufacturers of "Red Devil" Tools
264 Broadway New York, N. Y.

"Red Devil" Glass Cutters—the greatest standard tools of the world. "It's all in the wheel." Model in 42 sizes. No. 814 shear bit 25c

THE HOME WORKSHOP

Your Home Heating Plant

(Continued from page 78)

trated, to lead the stream of air into an ordinary stove pipe. This stove pipe projects into the air inlet and points in the direction of the furnace. The end of the pipe should be nozzle-like in shape. To make this, simply split the pipe down at the end in several places and bring the segments together so that they overlap to form a cone; then rivet them together.

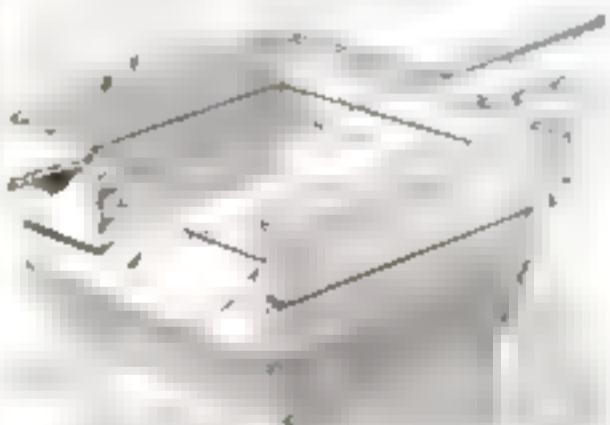
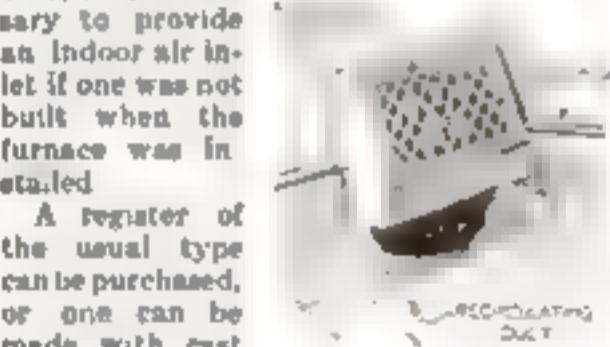
To get the maximum benefit of this recirculation system, cover the back of the fan also with a sheet metal casing and run a stove pipe from it either into the new inlet or right up to the first floor, so that all the air blown into the furnace will be from the living-room. This arrangement produces surprising results and sometimes saves as much as 22 cents on a dollar's worth of coal, according to heating engineers.

Another method of accomplishing the same result is to place a fan in a tin-lined box with ducts leading to and from the cold air pipe, as illustrated in the left-hand column on page 78.

The fan or blower does not need to be a powerful one; the average household fan will serve the purpose; but a regular ventilating fan or blower has the advantage of being a little sturdier in construction. A motor as small as 1/20 h.p. will serve and when fully loaded consumes only 38 watts or about three-fourths of the current consumed by an ordinary electric lamp. Therefore, the cost of operation is small.

The fact that so small a blower unit is required often makes it possible to place it directly in the air duct. When this can be done, it is necessary merely to have a door in the top of the pipe. In every case, however, it is necessary to provide an indoor air inlet if one was not built when the furnace was installed.

A register of the usual type can be purchased, or one can be made with cast iron and painted.



Method of installing floor and baseboard regulators for recirculating air duct

iron or steel grillwork, which can be obtained in all kinds of ornamental designs. By making use of this grillwork, it is sometimes possible to put a register in an odd shaped or awkward corner where a commercial size of hot air register would not fit.

The radiator, to give the best results from recirculation, should be 18 by 24 in. for a 4-pipe furnace, 20 by 26 for a 6-pipe

(Continued on page 101)



A Clean, Sharp Cut—Everytime!

—they can't wear out!

Neverlip cutting blades are made from special high carbon crucible steel. That's why they'll outcut and outlast any plier made. Crucible makes a strong tough edge that resists wear and remains sharp for a long time. But if you accidentally nick the edge you don't have to throw the plier away.

For Neverlip Pliers are made with renewable cutting blades—you merely remove the old blades, insert new ones and you have a brand new pair of pliers ready for use at small cost.

Neverlip Pliers will cut soft wire or insulation clean and even—no rough or ragged edges. They're guaranteed to outcut and outlast any plier made.

NEVERSLIP side cutting pliers

Just go into any hardware store and ask to see a pair of Neverlip Pliers. Look them over carefully. Note the sharp cutting blades. If you want to get real action and long life from a pair of pliers buy Neverlips. Most hardware dealers sell them. Write for leaflet.

THE NEVERSLIP WORKS

New Brunswick

New Jersey

Neverlip Pliers are furnished in six sizes and eight inch sizes

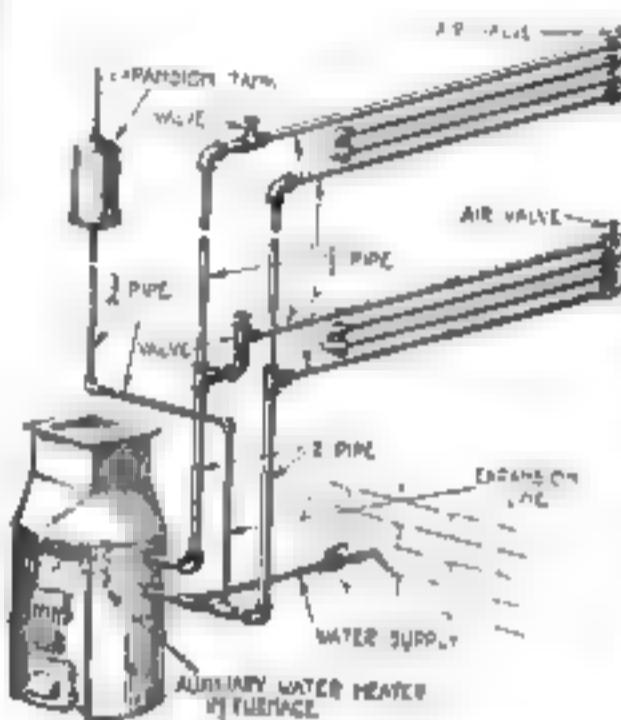


Your Home Heating Plant

(Continued from page 100)

furnace, 21 by 29 in. for an 8-pipe furnace, and 24 by 32 for an 11-pipe furnace. These areas are larger than the sizes of cold air ducts for furnaces of corresponding size.

The location of the register will be determined somewhat by the floor beams, which are placed 16 in. from center to center. Not more than one of these beams should be cut, and then headers should be placed across the opening to hold the ends of the cut beam and to prevent any possibility of the floor's sagging. Because of the danger of striking a nail, an old saw should be used



Auxiliary heating for shut-off rooms may be provided from water heater in furnace.

for cutting the opening in the floor. A baseboard register may be used if more convenient.

If the home worker does not care to undertake the sheet metal work himself, he can make a drawing showing the exact dimensions of the pipe and fittings needed and have them made up very reasonably at a tinsmith's shop.

Sometimes the installation can be simplified by using one or two of the existing hot air stacks as intake flues. The pipes going to the hall register and to the register or registers in one or two of the little used rooms of the house can be disconnected from the furnace and connected with the cold air duct. This requires little work and usually very little, if any, additional piping, but it is open to the objection that the area of the combined flues usually is not as large as if a single new inlet is provided. Unless ample provision is made for supplying air to the furnace, it will not give the best results.

In an emergency, a fan often can be used to aid the circulation of air by placing it with its back against a register so as to suck warm air out into the room.

Heating the Bathroom

When pipeless furnaces are used and it is desired to provide heat for the bathroom, nursery or other room that is shut off from the rest of the house for considerable periods, one of the most efficient methods is to install a hot water heating attachment inside the furnace and connect it with a hot water radiator or pipe coils, as illustrated above. Another method is to use a flue.

Continued on page 102

For Radio Batteries

Snap a Switch to Charge Your Battery



If you have a radio receiving set using a storage battery, haven't you often wished for a simple efficient means for recharging this battery without lugging it away to a service station?

Tungar

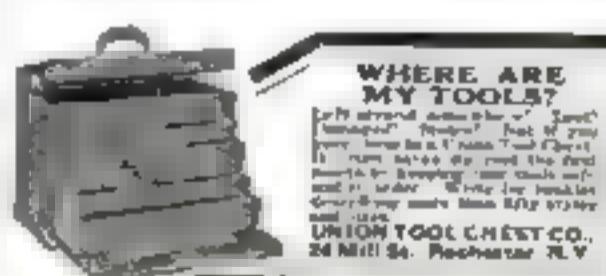
charges storage batteries from any alternating current lighting circuit with a minimum of expense and trouble. You can do your charging right in your own home and without lifting the battery from its present position.

The Tungar is not new—thousands have been used for charging automobile starting and lighting batteries for years. Tungar has no moving parts to wear out or require oil. It requires no attention while charging but may safely be left on the battery all night.

If your dealer in radio or other electrical supplies does not carry Tungar, write us and we will send you literature and tell you where you can get one.

General Electric

General Office Schenectady, N.Y. Sales Offices in all large cities



Standard Underwoods



**\$4800
to
\$12000**

If you become a Florida paint salesman, Our course equips you with the necessary knowledge. It is endorsed by leading paint manufacturers. They want to secure men who have considered it. Write for complete details of the course and our assurance of placing you with reliable company after you have graduated.

CLEVELAND POINT SALOMONOFF'S TUTORING SCHOOL
151 Main Street Cleveland, Ohio

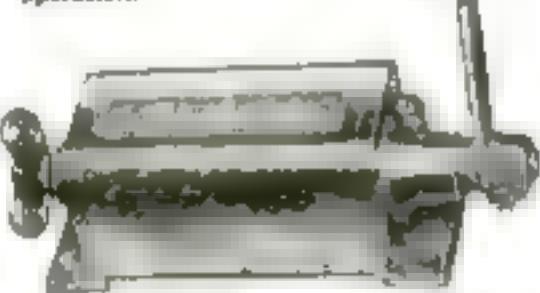
Sits There Watching a Lifetime of Work

If some mathematical wizard perched himself on your machine, totalled the output at lightning speed and told infallibly how the work was going, what would his services be worth to you? Would he be worth the price of a Veeder Counter—you can have him for that price. He's a Veeder Counter personified.

You're paying someone to count the product anyway, at some stage of operations. From now on, count it automatically instead. Increase the VOLUME automatically, by counting it in front of the machine operator—with a

Veeder COUNTER

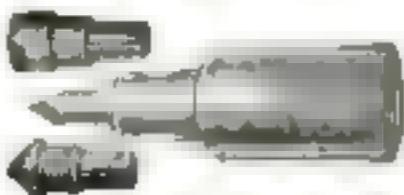
The Revolution Set Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Set back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, \$10.00—subject to discount. Cut less than one-half size. Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, \$11.50 (list).

Speed Counter

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft, press lightly when the second hand of your watch comes to 0, release pressure when minute is up. A spring clutch controls the recording mechanism.



(Cut less than 1/2 size.)

The Veeder Speed Counter enables you to keep motors, engines, generators, etc. running and machines operating at efficient speeds. Price with two rubber tips (as illustrated) \$3.50.

Send for free booklet no matter what you want to count—automatically or by hand.

The Veeder Mfg. Co.,
44 Sergeant St., Hartford, Conn.

THE HOME WORKSHOP

Your Home Heating Plant

(Continued from page 101)

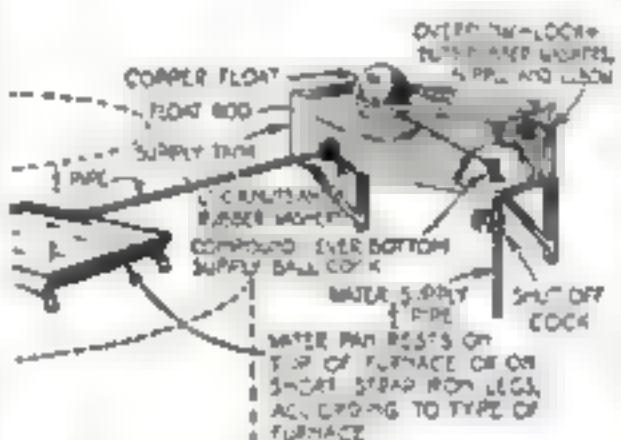
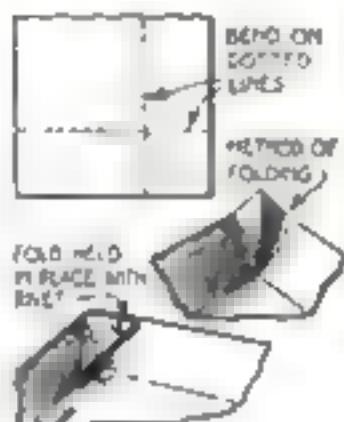
which can be made of a large stovepipe, connecting with the regular hot air chamber or an auxiliary hot air chamber made by increasing part of the smokepipe with a larger flue.

Such a flue, however, usually will not operate unless a fan is placed in front of it, and, therefore, it is generally easier to provide a separate gas, gas-steam, or electric heater for such a room.

Making a Self-Filling Humidifier

When the circulation of air is as good as can be made, it is not difficult to provide for a proper degree of moisture. Most furnaces have a water pan, but usually these are placed in such a way as not to provide a sufficient surface of water for evaporation. The best plan is to keep a panful of water on top of the furnace. It should have as large an area as possible.

The simplest way to obtain one the right size is to make it from a sheet of galvanized iron either by cutting the corners, turning them up, riveting and soldering them, or by bending up the edges and turning the corners in, as illustrated. With the latter method, a single rivet in each corner will hold the pan and no soldering is necessary.



Typical arrangement of water pan on top of furnace supplied from tank, and suggestion for making pan without soldering.

To avoid having constantly to fill the pan, it is well to provide a tank outside and both tank and pan can then be controlled by using a regular float valve. Any one who has had the most elementary experience in pipe fitting will have no difficulty in making the arrangement illustrated. The only point of importance is to provide an overflow in the tank so that in case the valve fails to work for any reason, the water will not flood down on the furnace itself.

To provide the proper degree of humidity in a steam-heated room is even simpler. It is merely necessary to change the air outlet valves on the radiators for some type of commercial valve that is designed to permit a certain amount of steam to escape and mix with the air of the room. The same result can be accomplished in a makeshift manner by taking off the valve cap and turning the adjusting screw a trifle so that

(Continued on page 103)



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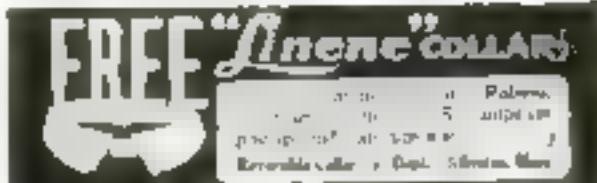


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Does this smoker know what he's talking about?

He says the best pipe of the day is the first one

A smoker from Zanesville, Ohio, who prefers to conceal his identity under the initials "A. K. K." insists that the after-breakfast pipe is far and away the best pipe of the day.

"Of course," writes A. K. K., "it depends somewhat on the breakfast. I couldn't get much joy out of a pipe after getting up from burnt oatmeal, bad coffee, and soggy toast. But after one of the breakfasts my wife can turn out, that's different!"

"Then when I step out on the porch and light up the old pipe, I very nearly approach the pinnacle of my day. As I figure it, one puff after breakfast is worth a dozen puffs after dinner."

"But please don't let this preference of mine for an early-morning pipe in any way injure my standing as an inveterate pipe-smoker. I smoke from breakfast until bedtime and get a lot of pleasure out of each pipe, provided always that I use the right kind of tobacco."

At this point it seems only fair to admit that A. K. K. is an Edgeworth smoker.

Thousands and thousands of smokers all over the country have discovered that Edgeworth is just the right kind of tobacco to suit their tastes.

Edgeworth may or may not be the right kind of tobacco for you. At least we want to give you the opportunity of finding out just what you do think about it.

Just jot your name and address down on a postal and we will send you immediately free samples, both of Edgeworth Plug Slice and Ready-Rubbed. If you will also include the name and address of the dealer from whom you usually purchase your tobacco supplies, we will appreciate the favor.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome tin humidores, and also in various handy in-between sizes.

For the free samples address Larus & Brother Company, 39 South 21st Street, Richmond, Va.

To Retail Tobacco Merchants If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Ready-Rubbed for the same price you would pay the jobber.



THE HOME WORKSHOP

Your Home Heating Plant

(Continued from page 103)

three or more studs, a hole for the brush screw, and two teeth or studs in its circumference 180 degrees apart. This piece is held securely to the shaft by a setscrew.

The trip lever *B* is provided with a cam made by bending a small piece of steel at an angle and riveting it in the position shown. A stop is made by sawing back a short distance from the end of the lever and bending the strip out. The thermostat is made by riveting together pieces of copper and zinc and fastening them at the end so that they can swing back and forth between the adjustable contacts. The unequal expansion and contraction of the two metals cause the arm to bend one way or the other in proportion to the temperature changes.

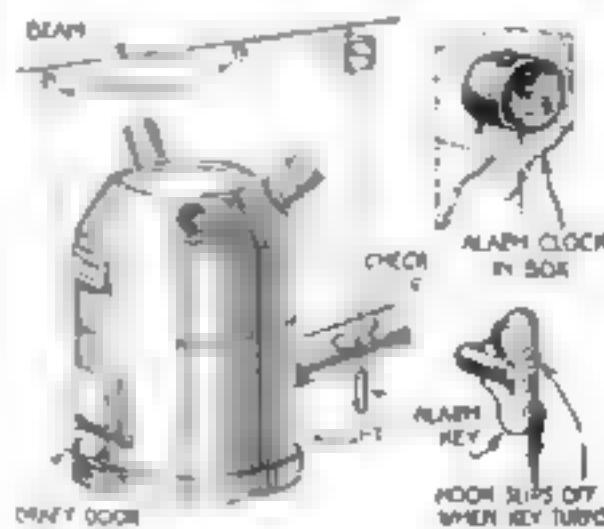
The thermostat makes contact for hot or cold, as the case may be, by bending to touch one or the other contact screws. When the contact is made, the plunger of the solenoid is drawn in. This moves the trip lever *B*, and releases the escapement wheel so that one tooth passes by. This tooth comes in contact with the cam and while passing over the cam causes the plunger to be withdrawn. The other tooth in the escapement wheel then comes in contact with the stop.

During this operation the shaft and crank on the end have moved through 180 degrees and the brush makes contact with the other terminal of the thermostat, so that the device is set for the time when the thermostat bends the other way and makes contact with the opposite screw.

To install a commercial type heat regulator it is usually necessary merely to mount the thermostat on an inside partition. The cable carrying the electrical connection is passed through a hole back of the thermostat and dropped down between the studs to the cellar. The only difficulty is to fish the cable through the floor. The regulating motor, whether spring or electric, is placed on brackets near the furnace in a position convenient for running chains to the draft and dampers.

Alarm Clock Operates Drafts

An alarm-clock regulator is easily installed even when a thermostatic regulator is not used. It costs little and serves for closing the dampers and opening the draft.



The device adapted for a standard hot air pipe furnace.

This saves making a trip down into the cold cellar the first thing in the morning.

The principle of operation is simply that

(Continued on page 105)

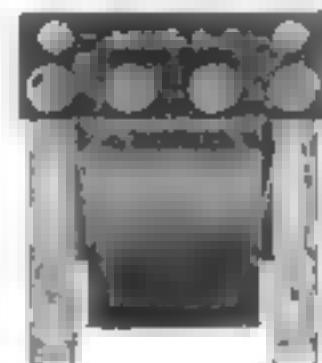


Choke off that "squawk."

AFTER all it is not always the bad vaudeville actors that "get the hook." Many owners have found an efficient hook to choke off the "squawk" of their radio sets and secure enjoyable music by adding Acme Audio Frequency Amplifying Transformers to the ordinary detector unit. Acme Transformers cost but five dollars, yet the results are almost marvelous. Not only do they amplify sound, but they bring it naturally—realistically. They are necessary to the proper operation of the Acme Clear Speaker which enables a whole roomful of people to enjoy the broadcasting concerts.

In order to get more than one broadcasting station and thereby pick out the concert you like best, you should also add an Acme Radio Frequency Transformer. This greatly increases the range of your set whether it be vacuum tube or crystal detector type. This wonderful little transformer sells for the same price as its twin brother the Acme Audio Frequency Amplifying Transformer. Your set is not complete without both these transformers and the Acme Clear Speaker.

The Acme Apparatus Company (pioneer transformer and radio engineers and manufacturers) also make detector units, the Acmefone, Acme C. W. and Spark Transmitters, etc. Write for interesting Transformer booklet if your own radio or electrical dealer cannot supply you. The Acme Apparatus Company, Cambridge, Mass. U. S. A. New York Sales Office, 1370 Broadway



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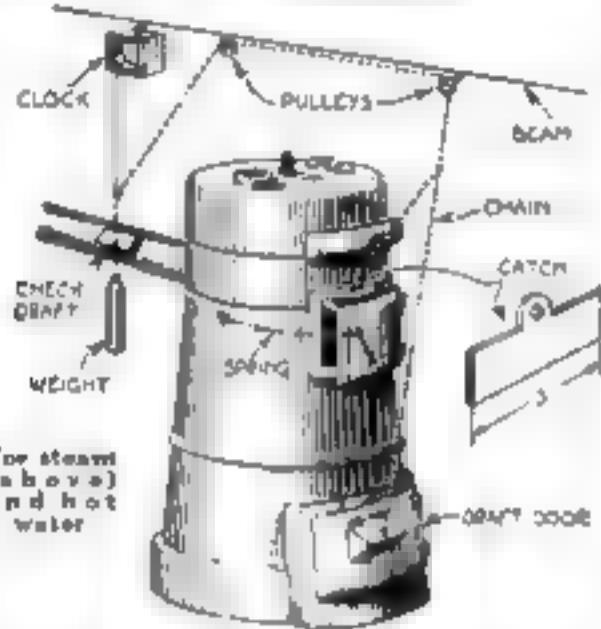
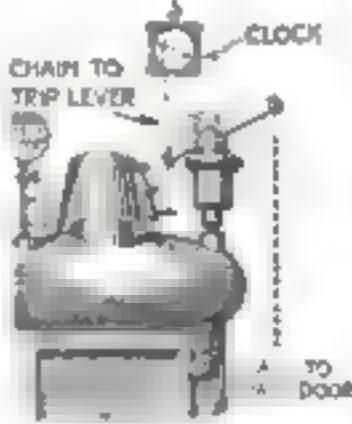
ACME
for amplification

THE HOME WORKSHOP

Your Home Heating Plant

(Continued from page 104)

when the alarm clock rings, it unhooks a weight that operates the drafts and dampers. The various arrangements of chains for hot air, steam, hot water or pipeless furnaces are made clear in the accompanying illustration. A few yards of chain, an ordinary alarm clock, a door spring, two pulleys, a sash weight or other lead weight



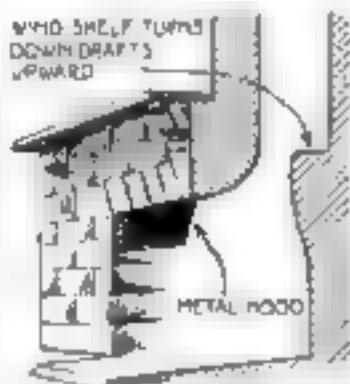
weighing from 6 to 8 lbs., will have to be purchased, and a small brass catch made for holding open the firebox door. In case it is the practice to open that door at night to check the fire.

The alarm clock should be inclosed in a box to protect it from the dust. The weight is attached to a length of chain and a hook in the other end is placed over the alarm winding key. When the alarm rings, this key turns and permits the key to slip off thus dropping the weight. This operates the drafts and dampers directly, except in the case of the firebox door in which case the catch above referred to is jerked out from between the open door and the door frame, and thus causes the spring to shut the door.

Obsolete or open fireplaces are, they nevertheless, in a time of coal shortage, offer a supplementary source of heat, because they will burn all sorts of odds and ends of wood that otherwise would be wasted.

Even newspapers rolled into bundles and burned in the fireplace throw out a surprising amount of heat. Many fireplaces, however, especially small ones in modern houses, are apt to smoke. This usually is due to poor design, the fireplace opening being too large in proportion to the smoke hue. It is difficult to do much without reconstructing the fireplace, but often the fireplace can be made to draw better simply by reducing the front

(Continued on page 106)



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Your Home Heating Plant

(Continued from page 165)

opening with a hood. This can be made at home of sheet iron or a hood may be purchased and fixed into the fireplace.

A great deal can be done to conserve heat in houses, stores and offices by preventing unnecessary waste of warm air.

The first thing for the home worker to do when cold weather starts is to place weather strips on doors and windows. (See Illustration at bottom of page 75.)

Try each window in turn and see if the sash rattles. For each window that is not absolutely tight, obtain 8 or 9 ft. of ordinary weather strip. This should be nailed with 1-in. brads to the blind-stop around the side and top of the window frame, outside the upper sash. Carry down the strips as far as the lower edge of the meeting rail. Be sure to press the weather strip against the sash so that it is a snug fit and yet not so tight that the sash sticks.

If the sash lock does not pull the meeting rails close, take off half of the catch, plug the holes, and replace it farther from the other so that the cam action will draw the meeting rails tightly together. If this does not make the window perfectly airtight, pry off the window stops, which are strips about $\frac{3}{4}$ by $1\frac{1}{2}$ in. on the inside, remove the nails by pulling them through the back, or cut them off and nail the stops back so as to hold the sash tightly. No

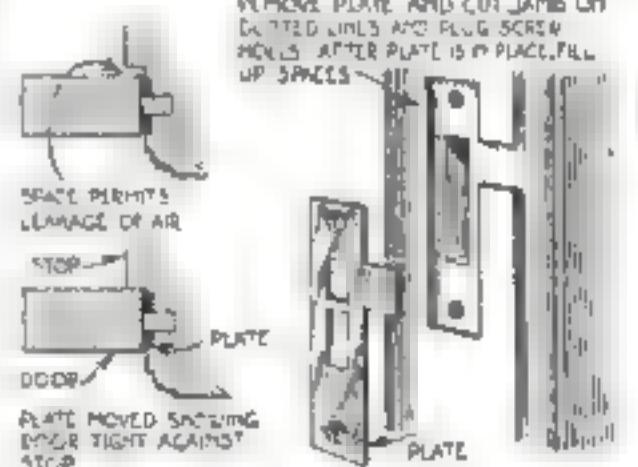
more play than the thickness of a piece of paper should be left between the stops and the lower sash.

The upper sash should have sufficient room to slide easily when started. It is not necessary to apply weather strips to the lower sash as a rule, although metal weather strips of

ingenious design can be obtained for going all around windows, even under the bottom rail, and making them almost completely airtight. To attach this kind of weather strip, ordinarily the sash must be removed; but the strips can remain on all the year, as they practically become a part of the window.

It is equally important to have the outer doors fit well, especially if storm doors or

REMOVE PLATE AND CUT JAMB ON DOTTED LINES AND PLUG SCREEN HOLES AFTER PLATE IS IN PLACE, FILL UP SPACES



Adjusting the strike-plate to make door fit better

vestibules have not been provided to form insulating pockets of air. The first step in fixing a door that is not tight is to remove the strike plate in the door jamb, plug the

(Continued on page 167)

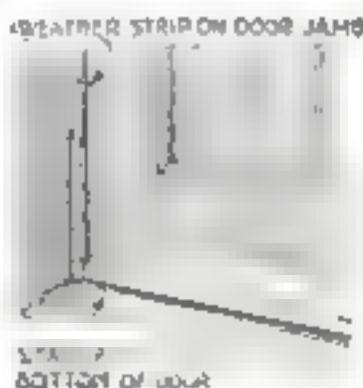
THE HOME WORKSHOP

Your Home Heating Plant

(Continued from page 105)

screw holes, chisel the mortise a little wider, and refit the plate so that it will hold the door closer to the door stop. A piece of weather strip should then be fastened on the bottom of the door with 1-in. brads or 1-in. No. 6 round-head screws. Place this on the side where it will not interfere with the opening of the door. If there are still any cracks, nail weather strip on both sides and at the top of the door-jam outside so that the rubber will press gently against the door when it is closed and locked. With exceptionally bad doors, it is sometimes advisable to nail strips of regular door stop $\frac{1}{4}$ by $1\frac{1}{2}$ in. around the jam so that it will be a tight fit against the door, and then place weather strip on top.

When the doors and windows are all tight, it is well to see if there are any places where warm air can escape from warm rooms either to the cellar or attic or through the house wall. The wall of a frame house itself is usually built so as to contain a number of air cells, as it were, since the building regulations usually provide for fire stops and the like to break up the long spaces between studs. Take the precaution, however,



KNOB
Axe
Hinge
Floor
Ridge board
Furring
Floor joist
Floor beam

to see that none of these wall spaces, which are so important in insulating the house, open into the attic or cellar. If any of them do, cover the spaces with building paper, wall-board, plaster board, or strips of wood. If the attic is of the unfinished variety and has no floor, the beams should be carefully covered with building paper, if nothing better, so as to provide a "dead" air space between the ceiling of the rooms on the upper floor and the attic.

In the same way, if there are any places where the cold air can penetrate between the inner and outer walls of the house, those openings should be closed with building paper.

The importance of taking these precautions becomes more apparent when it is remembered that lath and plaster do not form a good insulator. That is why it is desirable to have a layer of building paper over the inside of the studs as well as between the sheathing and the siding or other finishing material on the outside of a frame dwelling.

Dead air spaces are the best Insulators
(Continued on page 109)

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Illustration 1 page 14

THE HOME WORKSHOP

Your Home Heating Plant

(Continued from page 1)

of relatively low temperature. Therefore, if it is desired to insulate the hot air pipes in the cellar, they should be covered with corrugated insulating material or asbestos at least $\frac{1}{4}$ in. thick and not with solid asbestos cement or paper. Conversely if pipes such as steam or hot water are radiating heat at relatively high temperatures, they are best insulated with solid material.

The customary way of insulating pipes of the latter kind is to cover them with 1 in. thick asbestos or magnesia sections, covered with canvas. These sections are secured in place by lacquered brass bands.

Another method is to apply asbestos cement, which is obtained in powdered form and mixed with water. This is then covered with canvas and usually a coat of ordinary cement and water is applied to the whole with a brush.

In the various types of moderately priced frame dwellings now being built in vast numbers throughout the country, projections from the first floor are often used to break up the monotony of the otherwise boxlike construction and to give additional floor space without a corresponding increase of the cost of the foundation. Since these projections are usually exposed to the

BUTTING PAPER

FINISHED FLOOR



Method of placing mineral wool beneath floor. It also can be packed between inside and outside walls where necessary.

weather underneath, it is most important that the floor should be properly insulated.

The standard method of providing this insulation, and the easiest for the home worker to apply, is to place a layer of mineral wool below the floor, as shown. Even ashes are better than nothing.

Storm sash, doors, and porches should always be placed on an exposed side of a house facing the prevailing winter winds.

It is not difficult to fit and hang sash. Two thin rods should be used for measuring. Cut one the exact height of the window frame opening, and the other, the width. Test each sash with these rods. If it is too large, plane it off. Bevel the bottom edge to conform with the slant of the sill.

Special hardware can be obtained for hanging the sash and to allow it to be pushed open at the bottom for ventilation. Sash also can be obtained with one small pane, arranged to open like a small door, for purposes of ventilation, or with a ventilator in the bottom sash.

It is possible for the home worker to make his own sash without much difficulty and at some saving in expense. One of the simplest ways of doing this was described in POPULAR SCIENCE MONTHLY for last February, and working drawings for a simple, yet unusually attractive looking storm porch were given in the Home Workshop Department of last January.

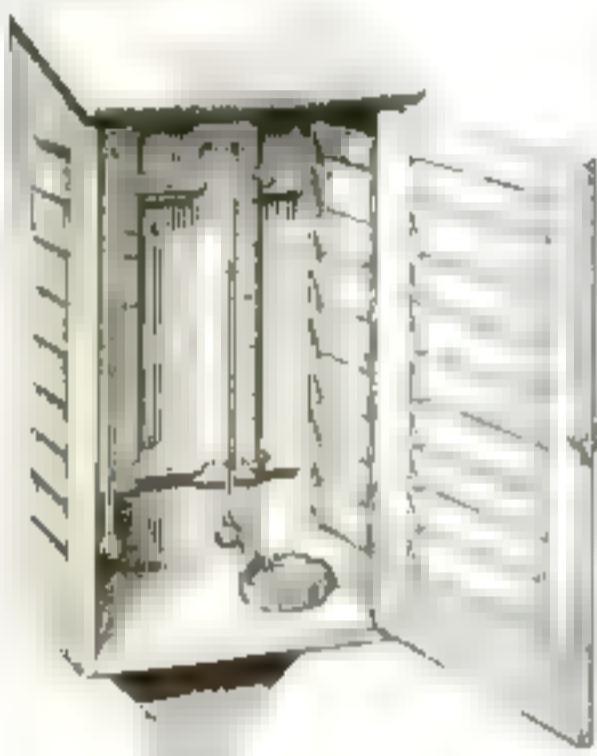
THE HOME WORKSHOP

Easily Made Hygrometer Will Measure Humidity in Air

By Capt. E. A. McCann

ONE of the secrets of heating a house economically and efficiently and keeping it comfortable through the winter months is to provide a sufficient amount of moisture for the air. If the humidity is right, a temperature of 65 or 67 degrees will feel as warm as a temperature of 70 degrees or more when the air is dry.

The humidity indoors should be approximately 50 per cent, according to competent heating and ventilating authorities. That is, the air should have half as much moisture as it is capable of holding. We could not live in perfectly dry air, and generally speaking the best degree of humidity for us is about 66 per cent, but with ordinary



The hygrometer consists of a wet and dry thermometer, the readings of which are compared in computing the humidity. For indoor use the instrument does not need to be housed.

heating plants it is usually next to impossible to maintain even 50 per cent humidity inside our homes in winter.

Temperature and water vapor in the air are, indeed, governing factors of climate and determine the wind and weather of the world, our various climates, and with them, our health and temper.

Humidity is measured by means of a hygrometer. This instrument consists in its simplest form of two thermometers, one wet and the other dry. To make one, therefore, you will require two thermometers. Be careful to see that they register evenly. They are suspended side by side and if they are to be used outside, they should be sheltered in a wooden screen standing about 6 ft. from the ground, with jalousies on three sides so that the air may freely circulate within but the sun and rain be excluded. The top should be slanted and project well from the sides all round. The bottom preferably should have jalousies like the sides.

The two thermometers are kept in position by brass clips or thumbscrews so that they can be removed for cleaning. The bulbs descend clear of the scales or supports.

Around one bulb tie a piece of thin muslin and fasten a few strands of cotton wick to

(Continued on page 110)

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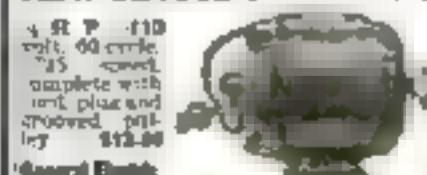
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THE HOME WORK-UP

Homemade Hygrometer

(Continued from page 109)

the glass tube above, letting them come in contact with the muslin. The strands descend into a small vessel of distilled or clean rain water placed near the wet and as far as possible from the dry bulb. Thus arrangement keeps the one bulb wet and the evaporation cools it and causes that thermometer to register lower than the other, the difference varying with the amount of free moisture in contact with the dry bulb.

Reading the Hygrometer

After you have taken the readings of the wet thermometer and the dry thermometer, subtract the first from the second. If the difference is less than 10, consult Table No. 1; if 10 or more, look at Table No. 2.

In either case, follow down the left-hand column until you reach the number nearest to the reading of the dry thermometer.

From that point follow straight along to the right until you reach the column directly under the figure (on the upper line) that represents the difference in reading between the wet and the dry thermometer. At that point you will find the percentage of humidity. For example: Wet thermometer, 64; dry thermometer, 67, difference, 13, humidity, 39.

TABLE No. 1

Difference in degrees between dry and wet thermometers when less than 10 points

Dry ther- me- ter	0	1	2	3	4	5	6	7	8	9
0	67	35								
5	74	48	22							
10	78	57	35	14						
15	82	64	47	29	12					
20	85	70	66	41	27	13				
25	87	74	62	50	38	26	14	8		
30	88	78	61	52	47	36	26	17		
35	91	82	73	65	54	45	37	28	19	
40	92	84	76	68	60	51	45	38	30	
45	92	85	78	71	64	58	51	44	38	
50	93	87	80	74	67	61	55	50	44	
55	94	88	82	76	70	65	59	54	49	
60	94	89	84	78	73	68	63	58	53	
65	95	90	85	80	75	70	65	61	56	
70	95	90	86	81	77	72	68	64	60	
75	95	91	87	82	78	74	70	66	62	
80	96	92	87	83	79	75	72	68	64	
85	96	92	88	84	80	77	73	70	66	
90	96	93	89	86	82	79	76	72	68	
95	96	92	88	85	81	78	75	71	68	
100	97	93	90	86	83	80	77	74	71	

(Percentage of humidity)

TABLE No. 2

Difference in degrees between dry and wet thermometers when 10 or more points

Dry ther- me- ter	10	11	12	13	14	15	16	17	18
22	16	8							
32	25	19	13	7					
38	33	27	22	16	11	6			
55	49	39	34	29	24	19	15	10	6
60	48	44	39	34	30	26	22	18	14
65	52	48	44	39	35	31	28	24	20
70	55	52	48	44	40	36	33	29	26
75	58	55	51	47	44	40	37	34	31
80	61	57	54	51	47	44	41</		



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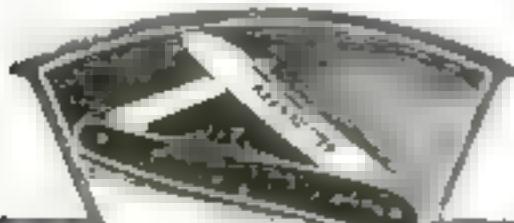
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THE HOME WORKSHOP

Homemade Hygrometer

(Continued from page 110)

For indoor use the screen is not necessary. With the temperature of a room at 50 degrees, each cubic foot of air should contain 3 gr. aqueous vapor; at 60 degrees, 4 gr.; at 70 degrees, 5 gr., that is, when the dry bulb stands at those points, the wet should show 45, 54, and 63 degrees respectively to give 66 per cent humidity. The figures are not the absolute amount of water vapor in the air, but the relative humidity with regard to the temperature at the time, because warm air holds more moisture than cold. Thus at 32° F., i.e. ft. of air can hold nearly 3 gr. of aqueous vapor; at 60 degrees it will hold 6 gr.; then for every increase of 27 degrees the holding capacity of a cubic foot is doubled. At a temperature of 30 degrees, for instance, the relative humidity of 90 per cent corresponds to 0.149 in. of vapor pressure, while 60 per cent at 80 degrees equals 0.511 in., or more than three times as much.

Hygrometer Not Affected by Frost

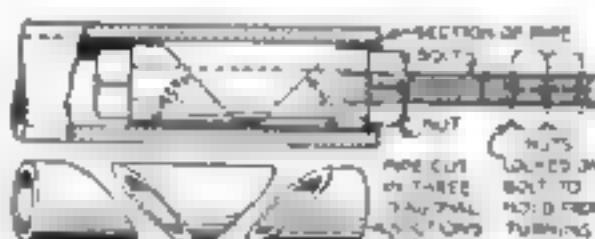
In frosty weather, when the muslin is thinly coated with ice, the readings are still valid, because evaporation takes place as freely from the surface of ice as from water, but if it is dry, wet it and let it freeze.

You can often foretell frost with this instrument, and so perhaps save delicate plants. When the temperature is below 45 degrees, take the difference between the readings and multiply by 25, subtract this from the reading of the dry bulb, and the result will indicate approximately the temperature to which the air will fall during the coming night. Moist winds or increasing cloudiness will, of course, sometimes falsify this forecast.

How to Fasten a Bolt in End of Pipe or Radio Mast

ON MANY occasions it is necessary to make a fastening at the end of a pipe in connection with a wireless mast, awning work, hand rail attachments, framing, and the like.

To hold a bolt in the open end of a pipe and leave the end portion protruding is



Tightening the nut expands the three pieces of pipe in the base

easily accomplished in such cases if the method illustrated is followed.

First obtain a 4- or 5-in. length of pipe smaller in diameter than the pipe to which the bolt is to be secured. Saw two cuts diagonally across the piece so as to separate it into three parts. The bolt is placed through these and they are inserted in the end of the pipe. The nut is then set up solidly so that the outside of the segments presses against the inside of the pipe.

The bolt can be tightened by taking up the nut. To hold the bolt from turning while tightening the nut, lock two nuts tightly at the end of the bolt to give a grip.—G. A. LUEKS.

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THE HOME WORKSHOP

Easily Made Wooden Flower Box Has Water Reservoir

HOUSE plants flourish in the wooden flower box illustrated, which has a self-contained reservoir for water. The water is poured down the tube shown in the upper right-hand corner of the photograph and rises from the bottom up into the soil. Thus prevents the caking of the earth around the plant.

Above the bottom of the box is a second bottom, the space between being about 5 1/2 in. in depth. This second bottom is not fitted closely because room must be allowed for expansion and to permit the water to rise. The inner bottom also has a



Water poured through hole stable in upper right-hand corner is stored between double bottoms

1 1/2-in. hole in the center through which the water passes upward. This hole is filled with a sponge to prevent the earth from falling through into the reservoir. Four short lengths of dowels are set into the under surface of the inner bottom to hold it up.

Making this box is what teachers call a butt-joint job and is, therefore, comparatively simple, but the joints have to be watertight, so good workmanship is required. The first model was made with mitred joints, which look better but are more difficult. Many of the boxes my pupils have made were strengthened with copper bands 1/4 by 2 in., fastened around the corners at the top with copper upholstery nails.—P. S. HALLOCK.

Old Wooden Bed Is Cut Down to Make a Settee

IF YOU have an old wooden bed stored away in the attic, it probably can be made into a useful and attractive settee.

Finishing nails and about six 8-in. screws were all the additional materials needed to make the settee illustrated, and the tools required were a saw, a hammer, and a screwdriver.

The footboard was cut in half to make the ends and arms of the settee. The side rails and some of the slats were used for the seat, and the high headboard, which was to form the back, was cut down and some of the unnecessary ornamental work at the top removed, resulting in the settee shown above.—E. W.



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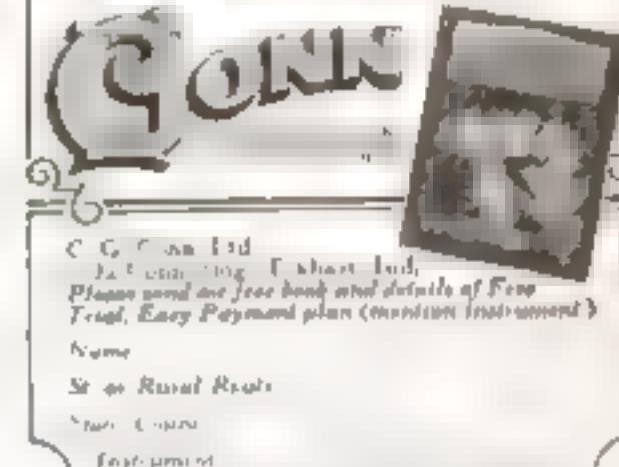
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THE HOME WORKSHOP

Discarded Picture Frames Make Attractive Serving Trays

OLD picture frames can be converted without much difficulty into substantial and attractive serving trays. In most attics there are old pictures with elaborately molded frames that have been put aside because either the picture or the frame has become old-fashioned. Often the frames are of walnut with moldings of good design, so that they will serve for making exceptionally fine serving trays.

The large serving tray illustrated, which is $14\frac{1}{4}$ by $19\frac{1}{4}$ in., was made from a frame that happened to be about the size of a regular serving tray. If the frame happens to be too large or is an odd shape, it can be cut down to the desired size and shape.

Crotonne, good reproductions of pictures that have decorative quality, Japanese prints, or commercial silhouettes, such as are sold for lampshades, can be used effectively underneath the glass. A study of commercial trays in a first class furniture store will provide suggestions for arranging these decorations. Sometimes an old, much prized pennant or a piece of embroidery or lace will prove attractive.

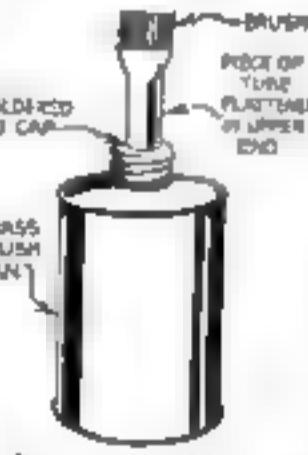
Brass handles, made especially for these trays, can be purchased reasonably. The bottom of the tray should be covered with felt, well glued on.

If an oval frame is available, it also may be used for a serving tray, even if quite small. Often such a tray looks better if it has wooden handles, and these too can be made at home. They should be of the same kind of wood as the frame, the handles themselves being about $\frac{3}{4}$ in. in diameter, and the rods by which they are connected with the frame no $\frac{3}{4}$ in. or less in diameter. Holes for these rods are drilled into the frame at an angle, and the rods are glued in place.

The first step in finishing a tray is to remove all the old finish from the frame. This can be done with a varnish remover, which will penetrate into all parts of the molding. Sandpaper the parts smooth and apply a coat of walnut, mahogany, or other stain, followed by two or three coats of shellac, rubbing down each coat a little with fine sandpaper. Then apply wax or varnish.—GLADSTONE CALIF.

Brush Fastened to Soldering Can

WHEN a number of parts have to be brushed with soldering fluid, it is a good idea to combine a brush with the container. This can be done by fitting a piece of tubing into the top of a can that has a screw cap, and placing the brush inside the tube. The end of the tube should be flattened slightly to hold the brush securely. H. B.



For speedy soldering

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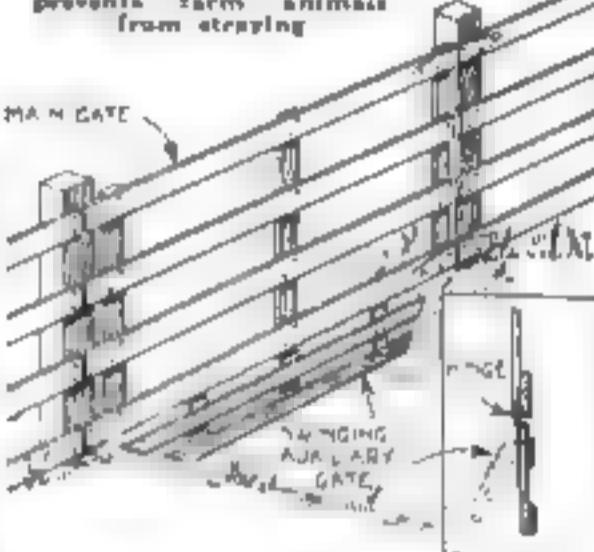
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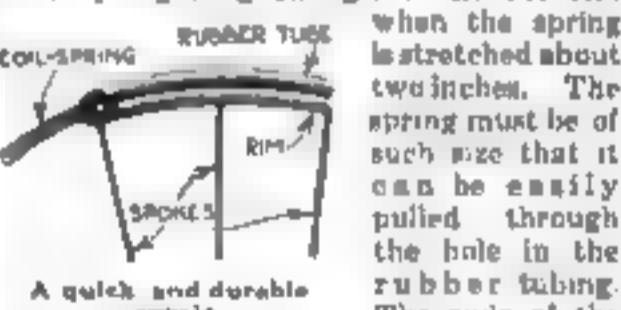


ary gate underneath the main gate in such
a manner that when the gate was opened
and swung back against the bank of the
road, the lower gate swung up, returning
to position of itself when the gate was
again closed.—LOUIS SCHNEIDER.

Spring and Tube Used to Re-Tire Baby Carriage Wheels

WHEN a baby-buggy tire wears out
often it is found difficult to secure and
to put on a new one. The following
method will be found very simple, cheap
and practical, and anybody with ordinary
mechanical ability can utilize it with ease.

Obtain heavy rubber tubing long enough
to fit around the rim of the wheel, and steel
wire spring long enough to fit the rim



A quick and durable
repair. When the spring
is stretched about
two inches. The
spring must be of
such size that it
can be easily
pulled through
the hole in the
rubber tubing.

The ends of the
spring are fastened together. This makes
a rubber tire that can be easily sprung
in its place on the rim of the wheel.

It was found that heavy rubber tubing
with thick walls containing some cotton, is
used for gas-stove connections and can be
secured at hardware stores. This tubing
was made to serve the purpose and wears
unusually well. The wire spring used is
the ordinary screen-door or bird-cage
spring. These are too short for the
average size wheel and it is necessary to
splice two pieces to make the proper
length. The splice must be as smooth as
possible, so that no free wire ends are left
to puncture the rubber tube.—M. E. K.

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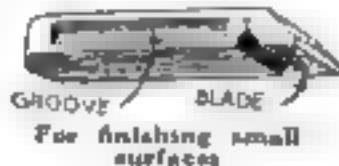
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around the amplifying tubes. A new
arrangement will sometimes make a big
difference in the signals.—S. B.

THE HOME WORKSHOP

Razor Blade Utilized as Cabinet Scraper for Fine Work

A HANDY and useful scraper for cabinet work can be made by inserting a safety razor blade in a wooden holder, as shown. The opening in the handle, which is a piece of soft wood, is cut on a scroll-saw or in any convenient manner, and a piece is also removed from the back to allow the shavings to escape. The shape of the handle is such that the blade stays in place while in use, yet can easily be removed.

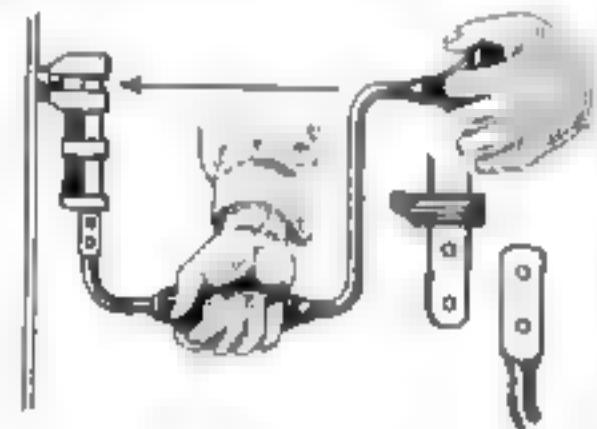


Any type of safety razor blade will serve and one blade will last for some time before it becomes dull.

This scraper is useful on fine cabinet work where an ordinary scraper would be too large. For example, one was used in finishing the end rails of an old table. It is also valuable for smoothing inlays. In places where even this scraper is too large, a safety razor blade alone may be utilized.—G. C.

Adjustable Socket Wrench Made with Old Bit Brace

IF YOU happen to have an old bit brace that has outlived its usefulness, you can convert it into an adjustable socket wrench. Saw off the chuck and beat and flatten the end so that you can attach to it a small

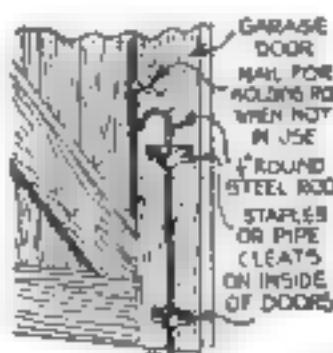


A powerful and speedy wrench for accessible work

monkey-wrench from which the handle has been removed and the shank cut down. Flatten the end of the wrench shank and place it against the flattened end of the bit brace so that the jaws of the wrench are directly under the round brace handle. In this position the two may either be riveted or bolted together.—S. W.

Stop Holds Garage Doors Open

THE stop illustrated will eliminate the danger of garage doors being blown against the car while entering or leaving the garage. A $\frac{1}{4}$ -in. round steel rod bent into a hook at one end and sharpened to a point at the other is held in place on the inside of the doors by two staples or $\frac{1}{4}$ -in. pipe cleats. A heavy nail or hook is driven into the door to provide a hanger for the stop rod when the doors are being opened or closed.—ALEXANDER GRABAU

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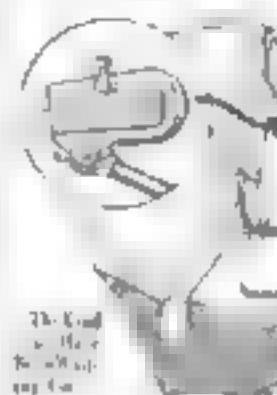
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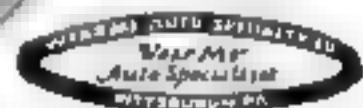
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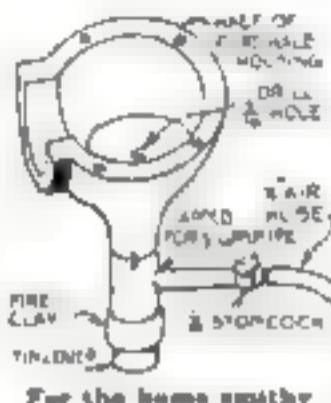
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THE HOME WORKSHOP

Ford Axle Housing Forms a Cheap Portable Forge

ONE half of an old Ford axle housing, which can be obtained at little cost from an automobile junk dealer, can be used for building a small portable forge that will serve many uses in the home workshop, garage, or small machine shop.

The housing is cut off so as not to be of unwieldy length, and fire clay and tin are used to stop up the ends. Air is supplied through a length of $\frac{3}{4}$ -in. pipe, to receive which the housing is tapped. The bell-shaped firebox of the forge is provided with a circular iron bottom, in which is drilled a 8 16-in. hole to admit the air.—G. F.



For the home smithy

Sharpening Shears with a Needle

THE sharpener for shears illustrated below was made with nothing more than a small piece of sheet copper, a darning needle, some thread, and a drop of shellac.

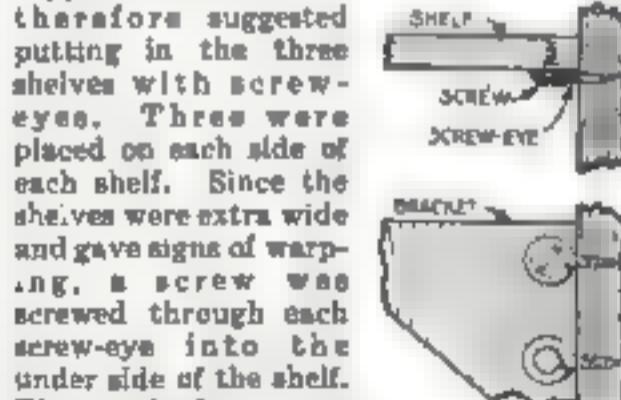
The copper, $\frac{3}{4}$ by $2\frac{1}{4}$ in., was bent up $\frac{3}{4}$ in. from one end. The thread was wrapped around the middle of the needle, which was placed in the bend and fastened with a touch of shellac.

The copper was then bent entirely over and clamped tightly with pliers. The extreme point of the needle was ground or broken off to prevent pricking the hand or fingers.

To use, place either end of the needle between the cutting edges of the shears and close the shears, allowing the needle to slide smoothly between the edges. Repeat the operation several times until a good edge is obtained.—JOHN A. GESSLER.

Screw-Eyes as Shelf Supports in Music Cabinet

ONE of my students who was making a music cabinet found that none of the local hardware stores had regular shelf supports in stock. I therefore suggested putting in the three shelves with screw-eyes. Three were placed on each side of each shelf. Since the shelves were extra wide and gave signs of warping, a screw was screwed through each screw-eye into the under side of the shelf. These substitute supports cost little, served the purpose well, and looked neat.—G. C.



Supports as seen from front and bottom of the cabinet shelves

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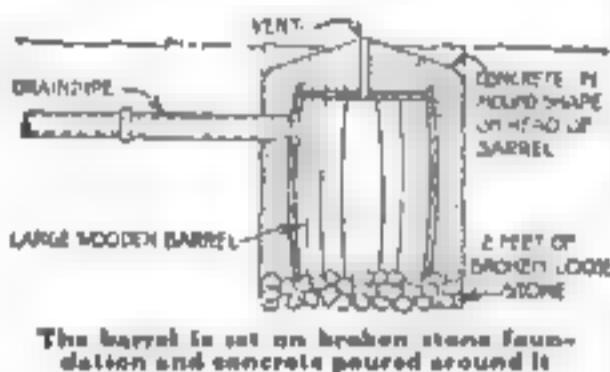
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THE HOME WORKSHOP

A Barrel Form Used in Making a Concrete Cesspool

A CESSPOOL for sewage disposal may be built with little more than two bags of cement and a large wooden barrel. A hole about 6 ft. deep is dug in the ground and then filled in loosely with rock and brick for a depth of 2 ft. The barrel is cut out at the place where the drain is to enter and is placed in an inverted position on the loose rock. A mixture of cement and sand



The barrel is set on broken stone foundation and concrete poured around it

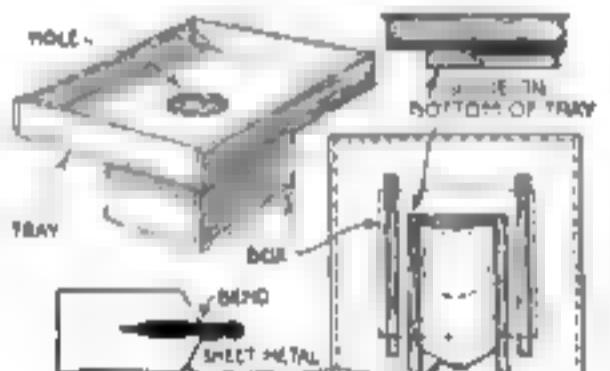
is then poured between the barrel and the surrounding wall of earth.

At the top of the barrel a 2-in. hole is fitted with a tin tube before the cement mixture is built up in mound shape over the barrel. This vent prevents any accumulation of gas from backing up the pipe. Eventually the barrel will rot away but the concrete walls will remain permanently.—G. A. LIVERA.

Tray for Sorting Small Parts

THIS tray will save much time in sorting the usual miscellaneous lot of nuts, bolts, screws, washers, and other small parts and fittings kept together in boxes or tins in the home workshop.

Place the sliding plate under the hole, dump the "junk" into the tray, spread out



This device makes it easy to find the right nut, screw, and washer without any delay

the parts, and you will be able to find what you are looking for in no time.

To put everything into the box again, get the tray on top of the box, pull out the plate and use it to scrape the scattered parts through the hole. D. W. CLARK.

"Shielding" Your Radio Set

SOmetimes when adjusting the knobs and dials of sensitive, closely regulated outfits the signals will die down as soon as the hand is removed. This is due to the capacity effect of the body. To get around it, cover the back side of the panel with tin foil or sheet copper, using care to see that the metal does not touch contacts, rods or wires. This is called a shield. At the point nearest the ground, connect the shield with the ground. W. J. T.

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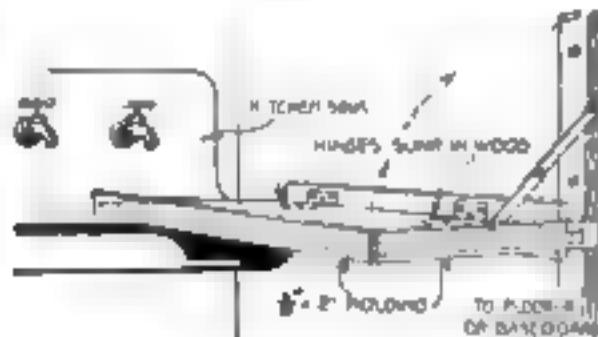
HOME OFFICE AND FACTORY: CHICAGO, ILL.

THE HOME WORKSHOP

Hinged Dripboard Provides Extra Space at Kitchen Sink

TO PROVIDE additional working space at the kitchen sink, I constructed a hinged dripboard as shown. The board was a piece of $\frac{3}{4}$ by 16 by 26 in. dressed California pine, to which were attached strips of $\frac{3}{4}$ by 2 in. molding. The seams were caulked on the inside with a mixture of litharge and enough distilled linseed oil to make a putty. After this paste had "set" for about a week, it became as hard as the board itself and thoroughly waterproof.

To mount the board, a strip $\frac{3}{4}$ by 5 by 24 in. was fastened against the wall horizontally and another strip $\frac{3}{4}$ by 5 in. by 5 ft. was placed vertically at one end of the first strip.



When not in use, the dripboard folds back against the wall.

These were screwed to the wall after it had been tapped and plugged.

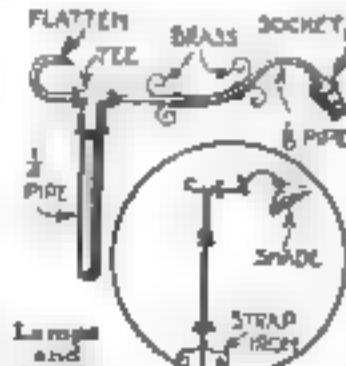
Two light steel 4-in. tee hinges were then used for hingeing the board to the horizontal strip in such a way that it inclined at an angle of 3 degrees toward the sink, the lower end projecting 2 in. past the rim of the sink. A stay for holding the board in position was made from two pieces of strap iron $1/16$ by $3/4$ by 6 in. I joined them by boring $3/16$ -in. holes and making a rivet from a 6.16-in. length of wire cut from a 20-penny nail.

The board, when folded back against the wall, is fastened with a hook and eye. The entire material cost me \$1.37 and proved an investment that was appreciated by the entire household.—WILLIAM H. DICK.

Gaspipe Forms Ornamental Reading or Piano Lamp

OLD gaspipe and a little strap iron and brass can be worked up into a practical and good looking reading or piano lamp at a cost of next to nothing.

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The lamp should be finished in dark bronze and the arms touched with gilt in polychrome effect. A suitable shade frame can be purchased.—PAUL W. TIER.

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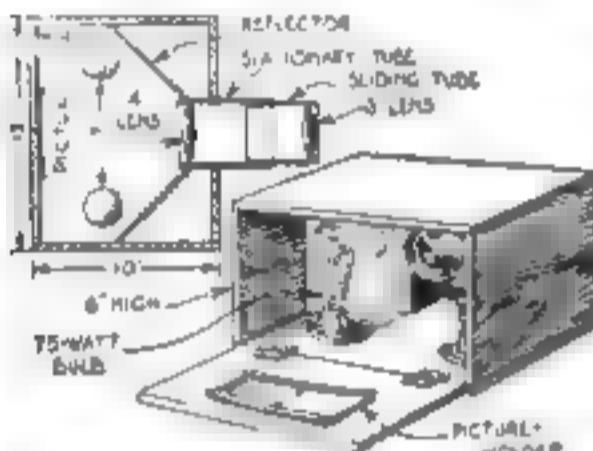
THE HOME WORKSHOP

Making a Projector for Picture Postal Cards and Photos

By Harry L. Gray

A POSTAL-CARD projector will provide an unlimited source of evening entertainment. The construction of the apparatus is not difficult if electric current is available. Two bulbs, preferably 75-watt, will be needed, as well as two reading-glasses. These can be 3 and 4 in. or 4 and 5 in. in diameter. The larger glasses will give a much brighter image on the screen.

A box to contain the bulbs, lenses and reflectors can be made of wood or metal. The dimensions indicated on the drawing will prove about right, but they can be varied somewhat to suit the material on hand. Hinged at the bottom, the back



The projector with door open, and view showing location of lights, reflectors, and lenses

opens downward to make easy the changing of the pictures. The postal-card holder should be slightly curved for best results, so that allows all parts of the picture to be brought into focus at once.

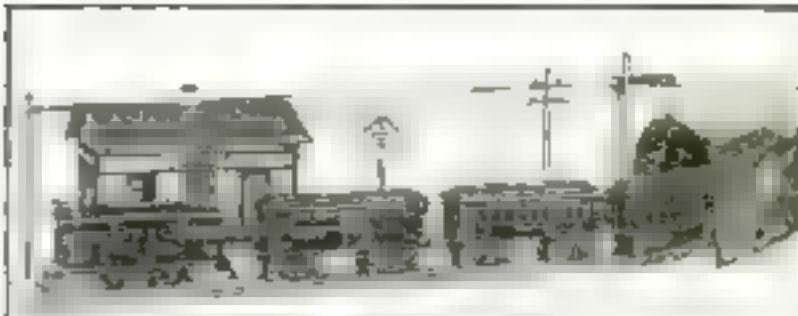
A reflector is placed in each forward corner of the box; these can be of bright tin or tin, enameled white. The interior of the box should be enameled white with the exception of the back and the lens tubes, which should be black. The lens tubes can be made of metal or cardboard, or sometimes two cans may be found that will slide within each other. One of the glasses is fastened in the end of each tube, the larger glass being placed to the rear. After the apparatus has once been focused, the tube with the large lens is fastened solidly in place and the smaller tube used for all further focusing.

In case electric current is not to be had, the constructor can use acetylene. Simply place a burner in the positions of the light bulbs, and use a tank or small acetylene generator.

Any kind of pictures may be shown, but they will be reversed on the screen. This is not, however, objectionable, unless there is lettering on them, in which event the pictures should be viewed from the back of the screen.

To Remove a Broken Ax Handle

A GOOD way to remove a broken ax handle from the eye of the blade is to saw off the wood even with the blade and drill a hole through the piece that remains incased within the steel. Next, make four cuts with a hacksaw, quartering the wood so that the four pieces can be driven out easily.—W. M. SCHMIDT

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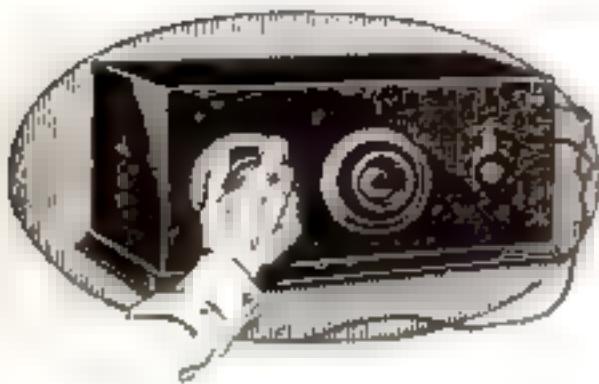
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THE HOME WORKSHOP

Screw Fastens Steel Wedge Permanently in Handle

THE accompanying illustration shows an effective method of permanently securing the wedge in the handle of a carpenter's or machinist's hammer, so that neither jarring nor the shrinking of the wood will cause the handle to come out of the eye of the hammer.



Then two parallel saw-cuts are made from the thick end of the wedge to the hole, so as to form a slot with rounded bottom.

The wedge is driven into the handle as shown in the picture and a wood-screw is screwed into the slot until its point is stopped by the rounded bottom of the slot. The projecting portion of the screw is then sawed off and filed smooth.—R. H. Y.

Hand Twister for Stretching Wire

STRETCHING fence wire is an easy matter with a tool such as is illustrated, which is simply a tee made of short lengths of 1-in. pipe.

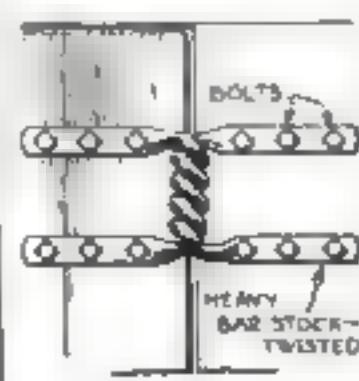
This tool is used by a Maryland farmer for practically all his fence work. The end of the wire to be stretched is passed through a staple to guide it and into a small hole in the stem of the tee, then being twisted about the pipe.

After the wire is tight, the staple is driven entirely in to hold it.—G. A.

Strong Hinges for Garage Doors

THIS simple form of hinge was made especially for garage doors. It was forged by heating two lengths of bar stock, and twisting them around each other. The ends were then flattened and drilled for bolts.

The construction is such that the weight of the door causes it to swing open when unlocked. By twisting the rods in the reverse direction the hinge could be made to swing shut if desired. It is practically indestructible and works easily when oiled.—S. L. J.



A self-opening or closing hinge

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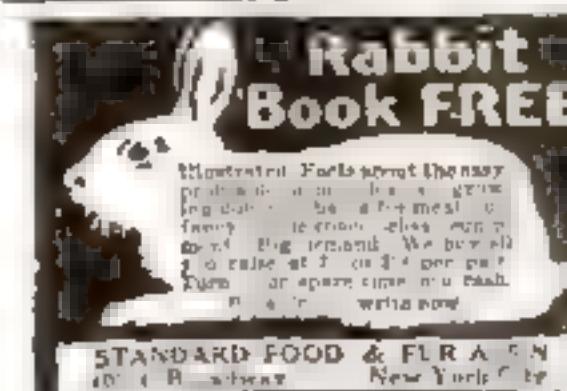
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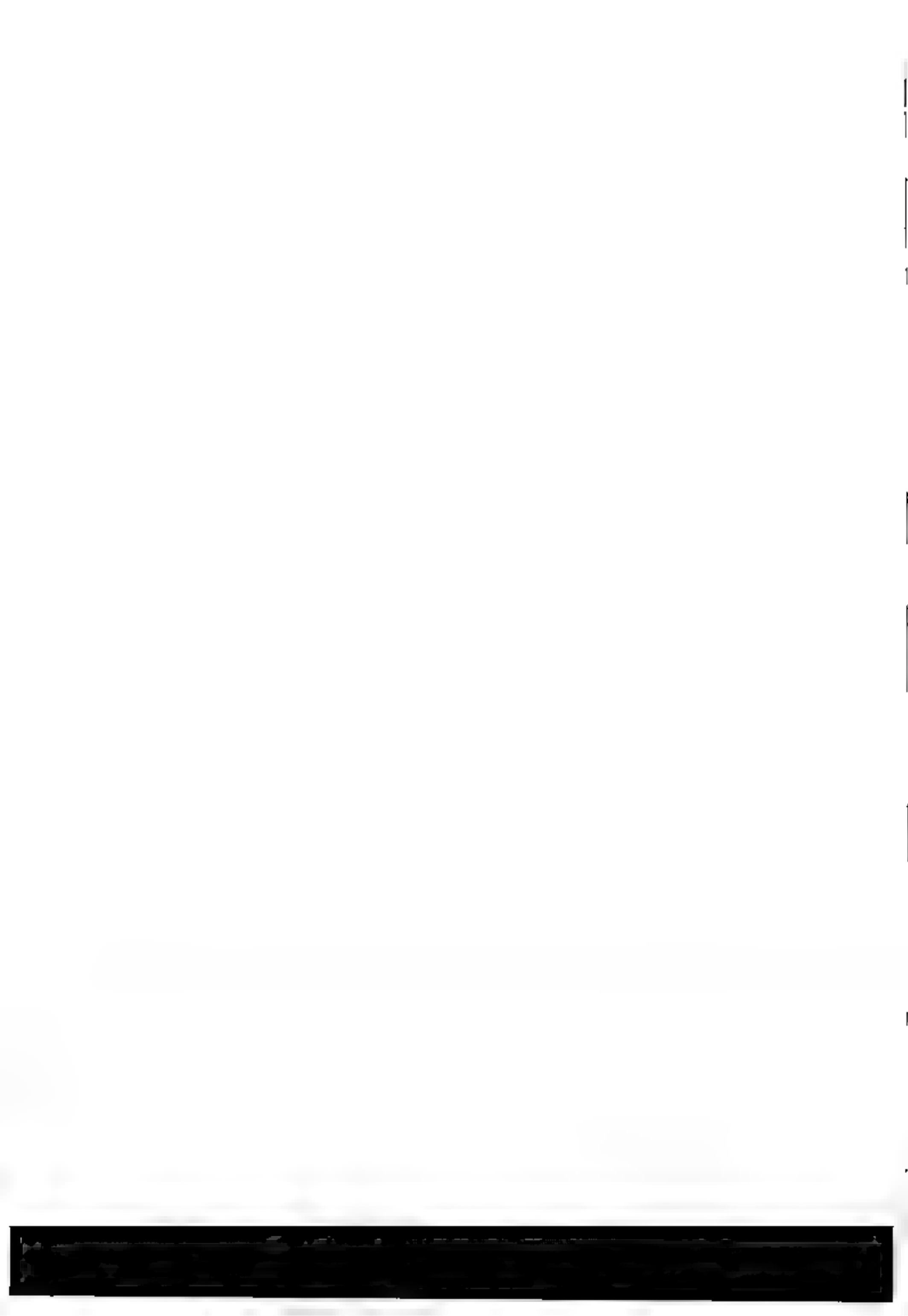
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THE HOME WORKSHOP

Miniature Radio Cabinet Has Slide Tuning Coil

A MINIATURE radio receiving set of the loose coupler type was under construction in which the primary coil was 4 in. long and $1\frac{1}{2}$ in. in diameter, wound with No. 28 wire. It was to be mounted in a little cabinet. Close tuning was desired, involving the taking off of a considerable number of turns. In such a small outfit this meant a lot of time, and time was limited. The same result was accomplished by using a slide tuning device.

The coil was fastened in the cabinet with the scraped contact path for the slider underneath, so that particles of metal worn off would fall away from the wire and not lodge between the turns and short circuit them. To an ordinary slider, from which



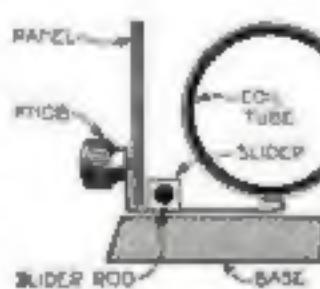
A sliding lower knob regulates wave length of this tiny crystal receiving set

the usual contact finger was removed, a brass plate was soldered, as shown. This was of thin spring brass. One end was cut down to form a flexible tongue and bent to make contact with the coil at the proper place, and the other end was bent so that it was vertical when in place.

The rod for the slider was placed close to the bottom of the cabinet, near the front. The composition panel, $\frac{3}{8}$ in. thick, did not reach quite down to the base, so that there was a slit about $1/16$ in. wide through which the slider plate projected. The bent part of the plate was parallel with and not quite touching the panel. To it a black composition knob was secured. This was quite a little job in itself. A brass screw was turned tightly into the socket of the knob and then cut off so that it projected only a trifle more than the thickness of the brass plate. The screw was passed through a hole in the plate, soldered and filed flush.

The slider was guided in its movement by the lower edge of the panel and the wooden base. The rod used was tubular, cut exactly to the length of the inside of the cabinet, and the ends tapped for machine screws. One end was held by a machine screw with the head countersunk in the wood, and the other by the screw of a binding-post for the ground lead.

A small crystal detector made up of a cup mounted on a nickelized angle plate, a rod with a catwhisker on one end and a binding-post knob on the other, and a binding-post through which the rod passed, were mounted on the panel. In all other respects the set is just an ordinary loose coupler on a small scale. The secondary is wound with No. 32 wire. Under favorable conditions, the set will bring in broadcasting over a distance of 25 miles.—HOWARD GRBENE.



Section through slider

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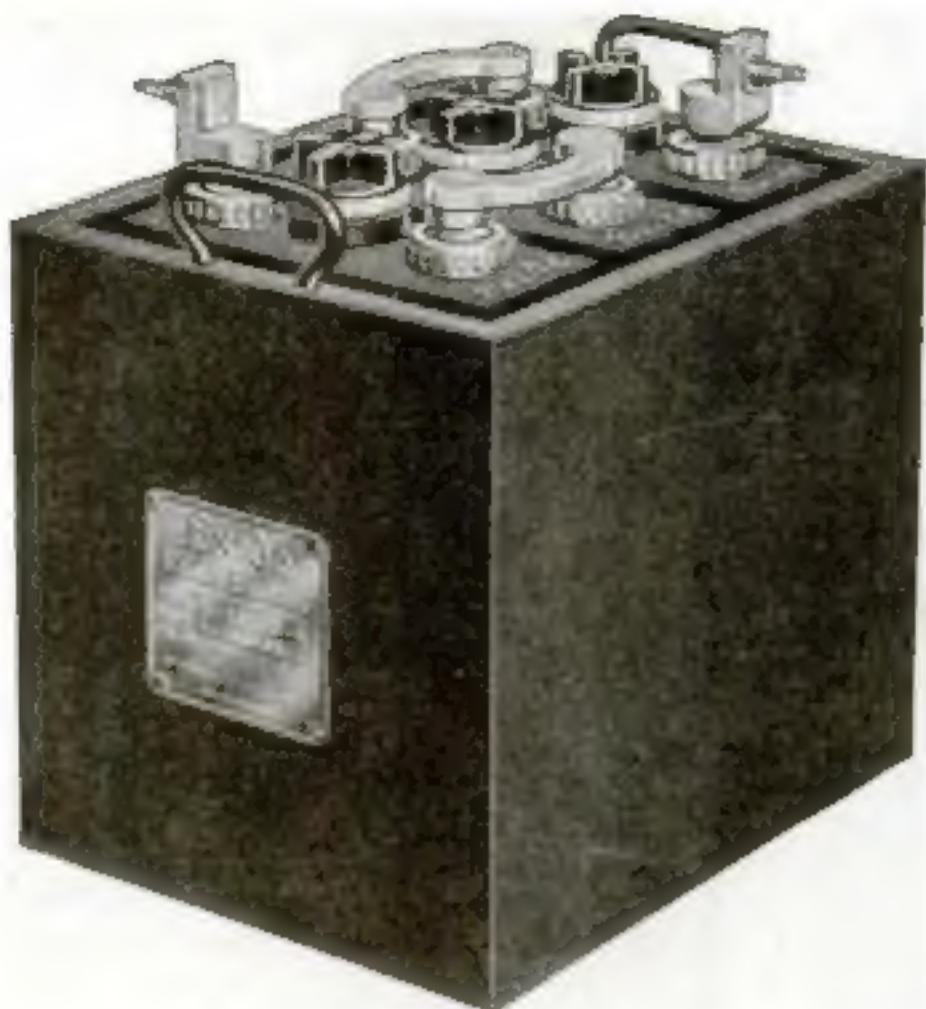
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